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Eau Claire, Wis., Paper Mill Begins Operations

Sterling Pulp & Paper Co., New Owners of Former Dells Pulp & Paper Co. Plant, Starts Production of Fruit Wrappers With Three of Four Machines—New Personnel Headed by Ely Meyer, President and Treasurer—Operations Will Probably Be Stepped Up to Full Capacity to Take Care of Large Tonnage Requirements

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., September 10, 1934—Operation was started Tuesday, September 4, of the Dells Pulp and Paper Company mill at Eau Claire, Wis., by its new owners, Sterling Pulp and Paper Company. It had been contemplated that the mill would be closed down for perhaps a week while a new executive and mill organization was set up, but due to the volume of orders flowing in, the mill was actually down only one working day, Saturday September 1, and the company took advantage of Sunday and Labor Day to make an inventory. Three of the four machines were started on Tuesday on the same grades as previously turned out, largely in the fruit wrapper line.

The organization meeting was scheduled at Eau Claire the latter part of last week, and the new personnel consists of Ely Meyer, president and treasurer; S. R. Davis and C. J. Hendricks, vice-presidents; Eugene O'Brien, vice-president and Superintendent and E. L. Holden, Secretary. It is reported that the mill will be stepped up to capacity within six weeks or two months to take care of Sterling's tonnage requirements for its large trade.

Consolidated Union Plan Succeeds

Because of the labor situation faced by mills under section 7-A of the NRA codes, a Labor Day statement issued for publication by C. E. Jackson, mill manager of the Wisconsin Rapids, Wis. division of the Consolidated Water Power and Paper Company, will be of interest.

Mr. Jackson states that the Consolidated signed its first agreement with the unions in 1919. The agreement was negotiated annually, but provided for the open shop. The mills at Wisconsin Rapids, Biron and Stevens Point, Wis., were included, but the Appleton, Wis. division was not organized until some years later.

"It was decided approximately ten years ago," adds Mr. Jackson, "to concede the so-called closed shop and this plan has been operating successfully. The company takes the stand that the union plan of collective bargaining is of mutual benefit, therefore the company and the union may justifiably insist that all employees support it. The employees who have opposed have been practically negligible in number.

"The following unions are included in the Consolidated organization: International Brotherhood of Paper Makers; International Brotherhood of Pulp, Sulphide and Paper Mills Workers; International Association of Machinists; International Brotherhood of Electricians.

"Monthly meetings are held between the union committees and company representatives. These meetings take place the second Wednesday of each month, and all grievances are presented at these meetings.

"The labor agreement stipulates wages, general working conditions, provisions for overtime, holidays, seniority rights, apprenticeship schedules, etc.

"The company and the unions state that the Consolidated system has been of great mutual benefit, placing important privileges and responsibilities on the shoulders of both. It is a business relationship, eliminating the obnoxious features of paternalism, welfare and benevolence. It holds no place for communism and is an effective guarantee against it."

Power Plants Pay Higher Taxes

Despite a huge reduction in their valuations, the power subsidiaries of a number of Wisconsin paper mills, along with other public utilities, will pay higher state property taxes than last year. The assessments and levies have been announced by the Wisconsin Tax Commission, and include and following tax payments:

Consolidated Water Power and Paper Company, $72,000.28; Eau Claire Dells Improvement Company, $32,823.66; Green Bay and Mississippi Canal Company, $23,294.31; Nekoosa-Edwards Light and Power Company, (Nekoosa-Edwards Paper Company) $2,858.83; Northern Power Company (Northern Paper Mills), $15,882.41; Wisconsin Hydro-Electric Company, $52,941.38.

Sensenbrenner Appeals Against Judgment

Attorneys for F. J. Sensenbrenner, president of the Kimberly-Clark Corporation, Neenah, Wis., appeared in circuit court at Oshkosh, Wis., last week to present motions after suit in the case won against him by Mrs. Lois Tom Nichol. A jury recently awarded her $22,600 damages on her plea that Mr. Sensenbrenner had concealed

(Continued on page 20)

Charles A. M. Vining, of Montreal, Heads Nemac

Newsprint Export Manufacturers Association of Canada Comprises Virtually All Dominion's Newsprint Producing Companies—Organization Formed Last Spring to Co-operate With U. S. Industry Under NRA, and to Deal With Other Canadian Newsprint Problems

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., September 10, 1934—The Newsprint Export Manufacturers' Association of Canada (Nemac) has appointed Charles A. M. Vining of Montreal as president. Z. J. Belnap, president of Consolidated Paper Corporation, who has been president of the association since its inception last spring, will continue to act on the executive committee, the other members of which are: F. W. Clarke, Anglo-Canadian Pulp and Paper Mills; G. T. Clarkson, Abitibi Power and Paper Company; A. R. Graustein, Canadian International Paper Company; A. E. McMaster, Powell River Company, Ltd.; and F. J. Sensenbrenner, Spruce Falls Power and Paper Company.

The association (Nemac) is comprised of virtually all of the newsprint producing companies in Canada. It was organized last spring, partly to cooperate with an association of the industry in the United States under NRA and, more specifically, to deal with the particular problems of the Canadian industry. It represents a new effort by the industry to cope with present difficulties and to seek a plan of stability.

Charles Vining, whose appointment as president of Nemac is effective immediately, is a director of the advertising firm of Cokfield, Brown Co., and has been engaged for the past six years in industrial planning and public relations work. Prior to this he was connected with the *Toronto Star* as associate editor of the *Star Weekly* and also as managing editor of the *London Advertiser*, when the latter paper was under *Toronto Star* ownership. He is well-known in Canada as a magazine and newspaper writer and has conducted a number of industrial investigations including a study of the St. Lawrence Waterway plan and a report of the newsprint industry published in 1930. He has also been connected with the publicity campaigns of the last three Dominion of Canada loans.

Mr. Vining is the son of the Rev. Dr. A. J. Vining of Toronto, served in France with Princess Patricia's Canadian Light Infantry, and graduated from University of Toronto in Political Science in 1921. He was born in Winnipeg and is thirty-six years old.

Gaspe Mills to Reopen

Premier Taschereau, of Quebec, has announced the impending opening of the mills at Chandler, Que., formerly owned by the St. Lawrence Pulp and Paper Corporation and the Bonaventure Pulp and Paper Company. The property has been acquired at auction by an as yet unidentified syndicate of capitalists which, the Premier reports, is to spend over $1,000,000 in getting operations under way. It is further announced that the proposal is to manufacture a new product, intended mainly for export, that will not compete with the production of existing mills. The equipment of the Chandler mill includes four digestors, and four wet and one dry machines. It has a capacity for the production of 300,000 lbs. of strong sulphite fiber per 24 hours.

Survey for Sulphite Mill

R. O. Sweeney, of Montreal, well known in the pulp and paper industry, is making a survey for a sulphite mill for British capitalists interested in supplying England with raw material for artificial silk and paper manufacturing. He has been in Vancouver, from which city it is reported that there are possibilities of the mill being established on the British Columbia coast. Mr. Sweeney, in an interview here, stated that he will report on two separate prepositions, a plant in Eastern Canada and one in British Columbia. He said he was not in a position to compare the relative merits of the two locations.

Fraser Co.'s Reorganization

K. S. Maclachlan, president of Fraser Companies, Limited, states that there has been "very encouraging" response to the suggestion made by the company to holders of 6 per cent. mortgage bonds to accept stock in lieu of interest for 1934. Owners of over $1,500,000 par value of the bonds have exercised the option of accepting common shares in lieu of interest. This will involve issuance of over 7,500 shares.

Under the terms of the reorganization effected in 1932, the company had the right to defer interest in respect of the year 1934. Such interest would then be payable in five equal annual instalments commencing July 1, 1939, with accrued interest. Bondholders, however, had the option of accepting, in lieu of the 1934 interest, common stock of the company at the rate of five shares for interest on each $1,000 of bonds. Such option had to be exercised not later than September 1.

In the latter part of July, Mr. Maclachlan addressed a letter to the bondholders announcing that the company had decided to strengthen the company's financial position. He pointed out that the company had made considerable progress in earnings as compared with last year, and suggested that bondholders exercise their option of accepting stock in lieu of interest. The amount of bonds outstanding, exclusive of accrued interest, is $8,200,000.

Export of Lumber

Uniform methods to increase lumber exports to the United Kingdom will be discussed at a special meeting of lumber experts to be held in Halifax, N. S., towards the end of this month and to which the Hon. J. H. McOnarrie, Minister of Lands and Forests in the Nova Scotia Government, has invited representatives of the Quebec and New Brunswick Governments. This meeting is one of a series, the first having been held in Montreal last spring, at which the Hon. Honore Mercier, Minister of Lands and Forests, and the Hon. L. P. D. Tilley, of New Brunswick were present.

Murray Bay Mill Starts on Newsprint

TORONTO, Ont., September 10, 1934—Donnahue Brothers, who recently took over the Murray Bay Paper Company's property from the bankrupt Abitibi Power and Paper Company, have reopened the paper mill with one of the two machines being engaged in turning out newsprint. The second machine is expected to start up before long. The paper is reported as being shipped to Hearst interests, who are understood to be negotiating for the property and will buy providing that the quality of newsprint manufactured comes up to expectations.

Chicago Paper Market Gradually Improving

Demand for Various Standard Grades of Fine Paper Increases Slightly—Book and Cover Papers Moving In Better Volume—Kraft Wrapping Paper Continues Dull, Although Inquiries Are More Numerous—Paper Board Only Moderately Active

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., September 10, 1934.—Abbreviated because of Labor Day, the Chicago paper market made a rather inauspicious start into the Fall season. Sentiment here indicates a belief that the Fall upturn will not be pronounced for some time as yet. However, stocks in many lines, particularly in krafts and kindred lines, are said to be exceptionally low. This situation is causing jobbers here to expect a rather appreciable upturn when the change does come.

A change in sentiment relative to the code situation is apparent—obviously due, according to reports, to tardiness in getting the code situation and amended provisions entirely ironed out and partly due to the fact that a slackened demand has made it more difficult to keep every one in line. There is, however, a genuine improvement in the conduct of business here, in the price range and in the general tone. It is doubtful if there is any part of the country where paper trade conditions are any better.

Markets, specifically, are little changed over the past week. Continued inability of the powers-to-be to settle the newsprint situation is having an unfavorable effect on both newsprint and ground wood markets where, if the position was clarified, there is sufficient undertone to denote improvement. Books and covers moved slightly better during the five days following Labor Day. Krafts were dull, although a slight pickup in inquiries was noted. Fine papers felt a slight increase due to demand for Fall business requirements. Paperboard was only fair while the waste paper market was also reported as quiet.

J. W. Butler Paper Co. Chartered

The J. W. Butler Paper Company has been capitalized with 10,000 shares of no par value stock according to the public records of the State of Illinois. The incorporators listed are Paul Butler, A. J. Gravelle and H. W. Recher. Offices are at 223 West Monroe street, Chicago. According to Butler officers interviewed the move was made largely to clarify and simplify the Butler organization in relation to the holding and operating companies. Little or no change will be registered in the direct conduct of the business itself. The incorporation took place after the name, J. W. Butler Paper Company, had been changed to the Butler Company. To simplify matters incorporation steps were taken to re-create the J. W. Butler Paper Company, according to information given here.

News of the Trade

Earl G. Meek is now in charge of the Chicago sales offices of the Tarentum Paper Mills. The new sales offices and sales personnel is located on the nineteenth floor of the Conway Building at 111 West Washington street, Chicago.

The packing division of the Pioneer Paper Stock Company has, for the past few weeks, been operating from 349 West Ontario street with the offices, however, still located at 448 West Ohio street where they have been for a considerable length of time. The new location gives Pioneer an opportunity to further expand and merchandise its packing and packaging material and to give an improved service to its customers. The division of the packing and office headquarters is reported as a much improved situation.

An enthusiastic group of one hundred mill executives and their families steamed away to Portland, Oregon, on the evening of September 5 bound for the annual sessions of TAPPI which get under way on September 10. The Northern Pacific special was loaded with a larger crowd than had been expected. The trip will take the TAPPI bound aggregation on a scenic trip through the western Rockies before it reaches its destination.

The Williams-Gray Company, dealers of paper mill supplies, recently announced the addition to its staff of Paul M. Foster, who was formerly with the Albany Felt Works and, prior to that, with the Beloit Iron Works. The Williams-Gray Company is located at 221 North LaSalle street, Chicago.

R. S. Bull, well known official of Bradner Smith & Co. has been selected by the Code Authority as one of a committee to handle trade practice complaints and make necessary adjustments. The plan for the duties of the committee and its personnel was submitted to General Hugh Johnson by the Code Authority for the Paper Industry. Seven paper executives from various parts of the country are on the committee.

The Quick Service Box Company has recently been incorporated to manufacture paper boxes and containers and has opened offices at 135 South LaSalle street. R. W. Schupp and Frederick Barth are listed as the chief incorporators of the new Chicago concern.

Omitting its September 3 meeting because of Labor Day, the Middle West Division of the Salesmen's Association of the Paper Industry plans its next weekly session for September 10, again at the Palmer House, instead of the Hamilton Club. Mr. Beatty, a member of the printing crafts code authority, is scheduled to talk to the salesmen at that time on the interrelating problems of the printing crafts and paper codes. The Monday session will also be utilized to iron out details relative to the final golf outing scheduled for the Flossmoor Country Club on the final day of the National Paper Trade Association meetings at the Stevens in Chicago.

Holyoke Tax Rate Reduced

[FROM OUR REGULAR CORRESPONDENT]

HOLYOKE, Mass., September 11, 1934—The tax rate for the coming year was announced the past week to the $28.50 per $1,000 a decrease of $2 over last year's rate. This makes a sizeable reduction on the tax of most paper mills and converters as well as others. The American Writing Paper Company, Inc., and Holyoke Water Power Company are two of the larger taxpayers. The assessors reduced the valuations in the city a total of over $4,000,000. The cases of the Crocker-McElwain Company and Chemical Paper Manufacturing Company are before the tax appeals board of the state for adjudication. The city paid about $13,000 to present its case before this board it became known at the last meeting of the board of aldermen.

Boston Paper Market Outlook Slightly Better

Number of Inquiries Around for Various Grades of Fine Paper, Some of Which Should Materialize Into Good Orders—Ledger, Bond, Writing and Book Papers Display Greater Strength —Wrapping Paper Exhibits Moderate Betterment—Box Board Quotations Steady

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., September 10, 1934.—As the month goes on a little improvement continues in the Boston wholesale paper market, which is encouraging to the trade. In fine paper lines there is considerable inquiry for large amounts of merchandise, which will undoubtedly develop into orders. With some, at least, August was slightly better than the preceding month, and it is felt that by September 15, the demand will be even more accelerated.

A fairly good amount of business was transacted on printing paper in some quarters. Ledgers, bonds, writings and book papers have generally improved. A moderate betterment is also reported in wrapping paper, although some report the market as still quiet. In some instances the demand is spotty.

In the fine writting paper district there was more interest in paper stock. Mills which have been quiet all summer made purchases more freely. In some quarters, however, a very quiet week was reported, with one of the largest consumers shut down all the week to make necessary repairs. No. 1 mixed papers and old newspapers sold at the minimum Government controlled prices. No. 1 old manila declined to .65 @ .70 from .75 @ .80, and manila to .55 @ .60 from .70 @ .75, but out of sympathy with minimum Government prices, in white blank news an advance was registered to 1.10 @ 1.15 from 1.00 @ 1.10, as well as in print manila, to .45 @ .50 from .40 @ .45, and in corrugated boxes, to .40 @ .42½ from .37½ @ .40.

On account of the textile strike, old gunny bagging is expected to advance, because so much cotton and wool is transported in bags, although the price of domestic gunny No. 1 declined during the week under review to 1.25 from 1.50. In the immediate future, at least, it is stated in the trade that those desiring to buy gunny will be obliged to pay a higher figure. It is reported that no spot lots are in store. Large quantities of bagging, rags, etc., come from the textile trade, which eventually reach the paper mills, and the shortened supply may enhance the value of certain grades.

During the current week, however, due to lack of demand, several other grades of bagging, with the exception of mixed strings, which advanced to .40 from .30, declined as follows. Transmission rope to .80 @ 1.00 from 1.25, jute rope to 1.35 @ 1.40 from 1.50 @ 1.60, scrap burlap to 1.05 @ 1.10 from 1.15 @ 1.20, new burlap cuttings to 1.45 @ 1.50 from 1.75 @ 1.80 and Australian wool pouches to 2.00 @ 2.25 from 2.25 @ 2.50.

News of the Trade

A combined banquet and sales meeting of Storrs & Bement Company was held in Rooms F, G and H of the Boston Chamber of Commerce Friday evening, when the advertising and sales policies of the Hammermill Paper Company, Erie, Penn., were outlined by the following, of the latter company: N. W. Wilson, first vice-president and general manager; Harrison R. Baldwin, assistant secretary and manager of sales; A. Ellis Frampton, assistant secretary and advertising manager; Roger Taft, New England representative, and Mr. Peto. William N. Stetson, Jr., president of Storrs & Bement Company, presided, with all the sales staff present.

A very enthusiastic sales meeting was held at the office of John Carter & Co., Inc., Saturday morning, with all the John Carter salesmen present. Reports from various territories were encouraging for fall business. Leon M. Poore, sales manager, presided.

An exceedingly satisfactory sales meeting of Carter, Rice & Co., Corp., was held at the office of the company Saturday morning in connection with advertising of the Strathmore Paper Company, West Springfield, Mass., placed for the fall and winter, which was discussed by their representative E. M. Hughes. Guest speakers were H. A. Moses, president of the Strathmore Company, who talked on his early experiences in the paper business, and John D. Zink, vice-president of the concern, who discussed the prospects for the sale of quality papers in the future. Frank Winter, sales manager of Carter Rice & Co., presided.

C. A. Wiswall, of the Consolidated Paper Box Company, Somerville, Mass., received a visit last week from one of his cousins, A. A. Curtis, of Newark, Del., whose father built the Nonantum Paper Mills in that place. Mr. Curtis succeeded his father, but sold his interests in the concern four years ago and retired from business. The business is now carried on by the Curtis Paper Company.

Mr. Curtis and Mr. Wiswall visited a stone mill at Newton Lower Falls, erected as a paper mill by Mr. Curtis' grandfather, Solomon Curtis, in 1810, now operated as a woolen mill. The stone walls of the mill are 24 inches thick. Some beams now in the structure, 18x24 inches, are still in good condition. Paper in this mill was made by hand at first, but later two machines were used, probably the first paper machines in this country. At that time England banned the exportation of paper-making equipment, so these machines were smuggled out of that country. For years the windows of the mill were screened with iron bars to prevent spies from seeing the machines.

Emerson A. Morse, Jr., has been appointed resident manager for the Charles F. Hobbs Company, large paper distributors, of Lafayette street, New York City. The local office is at 66 Broadway, Cambridge, Mass.

Joseph D. Snell, treasurer of the Von Olker-Snell Paper Company, left Tuesday for a two weeks' motor trip through Maine and New Hampshire, accompanied by Mrs. Snell and their daughter.

W. P. Simonds, treasurer of Train Smith Company, dealers in rags and paper stock, has sailed for Europe on a pleasure trip, accompanied by Mrs. Simonds.

Ted Pell, a sales representative of the Brown Company, with headquarters at the Boston office, has returned from a month's vacation in the West.

T. Stewart Foster, president of the Foster Paper Company, Utica, N. Y., passed two days in Boston last week with the local representative of the company, E. J. Smith, calling on the trade. Mr. Foster reports a very good business from the mill end. He was on his way back to Utica, after passing his vacation with his family at Camden, Me.

Demand for Paper Listless In Philadelphia

Little Improvement Experienced In Request for Practically All Standard Grades of Paper—Protracted Holidays and Textile Industry Troubles Generally Considered Contributory Factors In Retarding Revival of Normal Seasonal Trading

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., September 10, 1934—With the Jewish holiday intervening so closely after the Labor Day holiday and the fomented textile industry strike in progress, business in the paper industry shows little or no improvement, and it might well be said that these are contributory and salient forces in putting a damper on expectations of resumption of sizable demand.

Due to this textile strike, board mills particularly are keenly feeling the perceptible loss of business in the quantities of corrugated paper board, containers and wrapping paper used in shipping textile products, and it is confidently hoped that some fairly marked contraseasonal improvement will take place when their difficulties have been adjusted.

Association Activities

In line with pre-winter activities of the Paper and Cordage Association of Philadelphia, there was issued to all its members the following statement in part, over the signature of George K. Hooper, president:

"Our association, as a result of the untiring efforts of your officers and members, has assumed proportions far beyond the expectations of its originators. We all should be proud to be a member of an organization that has for its objects, the promotion of good fellowship and the increased interchange of business among the members. Those who have made the rapid growth of the association possible, have devoted their time and efforts because they believe that 'in proportion to that we do for others, will we be benefited.'

"Marcus Aurelius once said, 'That to have a friend, one must be a friend.' Was there ever a time in the history of the paper and twine business, when friendship played such an important part in our lives as today? I do not believe that any similar organization offers such an opportunity for manufacturers and distributors of paper and cordage to develop friendships to compare with those that are created in our association. The dues for twelve months are only $5.00 dating from the time application is accepted. Members and friends participate in the annual Spring outing at some country club and play golf, tennis, quoits, etc., for silver cups and prizes. At our Christmas meeting fifty deserving children under the supervision of the Salvation Army are entertained and given clothes, toys, candies, etc. The ladies are invited to join the members on this occasion. Last December, over 100 attended this celebration which was thoroughly enjoyed by all.

"The worthwhile things in life are the intangible things, which help us to carry on sometimes, when Dame Fortune ceases to smile upon us."

Pledges for attendance at every meeting this Fall and Winter were enclosed and a cordial invitation to join for all those not already in the membership is extended. Mr. Hooper further says: "Many thousands of dollars have changed hands among the members as a result of the unique folders containing letterheads of the respective members."

The first Fall meeting of this association is scheduled for September 21 at the Adelphia Hotel. Leslie C. Bartlett, Eastern Paper Company, chairman of the Entertainment Committee, is planning a very enjoyable program for this particular meeting. The latest addition to membership is Joseph Parker & Son Company, New Haven, Conn., one of the oldest blotting manufacturers in the country. L. H. McGreen, 401 Broadway, New York, will represent the Parker Company at the meetings.

Waste Paper Code Conference

Harry M. Bailey, of the Hemingway Company, Philadelphia, has just returned from attending a joint conference of a committee representing the Code Authority of the Paper Board Industry and a committee of the Waste Paper Code Authority. The purpose of the conference, it was explained by Stanley Osserman, counsel, was because of the emergency minimum price order that had been issued by the NRA which directly affected the waste paper industry and its consumer, the paper board industry. Mr. Osserman further said that it was to enable the members of the waste paper trade to comply with the labor provisions established in their Code, and the manner in which the minimum price provision as regards grading was operating was thoroughly discussed.

The Waste Paper Code Authority representatives stated that failure on the part of the consuming mills in the eastern section of the country to continue their normal buying operations since the date of the enactment of the order was causing a grave misunderstanding between the industries. David Charak of the Federal Paper Stock Company, Inc., St. Louis, and chairman of the Code Authority for waste paper dealers, recommended that monthly conferences similar to those held in the West, between board mills and waste paper dealers be established in the East. He pointed out that frank conferences of this nature eliminated misunderstandings and grievances between the industries, and made possible sound constructive co-operation.

News of the Trade

Paper Merchants, Inc., have signed a long term lease for the headquarters now occupied by them at 140 North Sixth street. Their offices have been redecorated, embodying many unique improvements, thus enabling them to carry out a program of expansion which has just been adopted by this company. A complete new price list is being distributed as of September 1st.

Earl J. Leigh, for a number of years connected with the Whitaker Paper Company, of Baltimore and Washington, has joined their sales force.

Winfield Predmore, president, and O. Freile, vice president, were in attendance at the 23rd sales conference of the Hammermill Paper Company, recently held in Erie. Mr. Freile reports the general trend of opinion at this conference, to be buoyant and optimistic.

B. M. Thomas, plant manager, Eastern Division of The Container Corporation of America, has been vacationing in Maine.

A truck load of paper owned by the Penn Paper and Stock Company, 217 Race street, was afire at Eighth and Race streets this week, and for some time tied up traffic while firemen extinguished the blaze.

Census of Pulp, Paper and Paperboard

The Bureau of the Census has just issued the following final report of the census of manufactures, 1931 on paper and allied products:

Pulp (Wood and Other Fiber)

This industry embraces establishments engaged primarily in the manufacture of pulp made from wood and other fiber. The greater part of the pulp produced is consumed in paper mills operated by the same establishments. At censuses prior to that for 1927 the manufacture of pulp and the manufacture of paper were combined under a single industry classification, "Paper and Wood Pulp."

TABLE 1.—SUMMARY FOR THE PULP INDUSTRY, FOR THE UNITED STATES, 1931, 1929, AND 1927, AND FOR STATES, 1931

[Statistics are given for all States for which separate figures can be published without disclosing, exactly or approximately, the data reported by individual establishments. Certain of the "Other States," however, are more important in the industry than some of the States shown separately.]

	Number of establishments	Wage earners (average for the year)	Wages	Cost of materials, fuel, and purchased electric energy	Value of products	Value added by manufacture [1]
United States						
1931 .....[2]	198	20,219	$22,843,982	$110,668,220	$166,559,043	$55,890,823
1929 .....[2]	198	24,729	32,679,407	148,752,729	238,928,279	90,175,550
1927 .....[2]	219	24,794	31,527,358	151,325,425	218,198,201	66,872,776
Per cent of increase or decrease (—):						
1929-31		—18.2	—30.1	—25.6	—30.3	—38.0
1927-29 ...—	9.6	—0.3	3.7	—1.7	9.5	34.8
States, 1931						
Louisiana ..	6	847	$914,700	$3,349,285	$5,859,372	$2,510,087
Maine	26	3,134	3,829,811	22,255,455	28,849,091	6,593,636
Mass.	3	209	218,693	747,120	1,189,597	442,477
Michigan ...	10	685	775,842	4,324,594	6,146,172	1,821,578
Minnesota ..	6	495	562,363	3,493,016	4,899,751	1,406,735
New York..	45	2,022	2,282,395	13,812,325	19,147,345	5,335,020
Oregon	7	704	919,209	4,122,759	5,739,859	1,617,100
Pennsylvania	9	1,105	1,223,989	6,937,239	10,186,496	3,249,257
Tennessee ..	6	515	548,262	2,483,997	4,710,768	2,226,771
Vermont ...	3	75	90,414	428,396	534,442	106,046
Virginia ...	8	1,299	1,244,119	6,046,413	10,574,048	4,527,635
Washington	17	2,155	2,877,343	11,448,733	17,756,615	6,307,882
Wisconsin .	27	2,807	3,269,280	16,827,583	25,127,337	8,299,754
Other States[3]	25	4,167	4,087,562	14,391,305	25,838,150	11,446,845

[1] Value of products less cost of materials, fuel, and purchased electric energy. See sec. 10, p. IV.

[2] The 198 establishments reporting for 1931 operated 204 mills (5 of which manufactured pulp from materials other than wood); the 198 establishments reporting for 1929 operated 208 mills (3 of which used materials other than wood); for 1927, the number of establishments and the number of mills were identical.

[3] Alabama, 2 establishments; Arkansas, 1; Delaware, 1; Florida, 1; Maryland, 2; Mississippi, 2; New Hampshire, 7; New Jersey, 1; North Carolina, 3; Ohio, 2; South Carolina, 1; West Virginia, 3.

TABLE 3.—PULP—PRODUCTION, BY PROCESS, FOR CONSUMPTION AND FOR SALE, BY QUANTITY AND VALUE, FOR THE UNITED STATES: 1931 AND 1929

[See also report, "Pulpwood Consumption and Wood-Pulp Production," p. 23]

Process	1931 Tons (2,000 pounds)	1931 Value (f.o.b. mill)	1929 Tons (2,000 pounds)	1929 Value (f.o.b. mill)
Pulp industry, all products, total	.....	$166,559,043	.....	$238,928,279
Pulp	4,479,193	164,934,240	4,937,235	234,759,420
Products other than pulp (not normally belonging to the industry)[4] ...	.....	1,624,803	.....	4,168,859
Pulp (wood and other fiber), aggregate...	4,479,193	164,934,240	4,937,235	234,759,420
For consumption[3].	[3] 3,823,910	[3] 131,279,710	[3] 4,167,749	[3] 183,261,193
For sale	[3] 655,283	[3] 33,654,530	[3] 769,486	[3] 51,498,227
Wood pulp, total.....	4,409,344	156,174,967	4,862,885	223,178,096
For consumption[3].	[3] 3,789,204	[3] 127,606,848	[3] 4,122,515	[3] 177,097,187
For sale	[3] 620,140	[3] 28,568,119	[3] 740,370	[3] 46,080,909
Ground, steamed, total	85,514	2,412,412	163,238	6,605,759
For consumption[3]..	81,054	2,304,499	158,014	6,446,183
For sale	4,460	107,913	5,224	159,576
Ground, not steamed, total	1,363,726	31,687,745	1,474,415	40,617,139
For consumption[3]..	1,334,477	30,831,547	1,447,135	39,763,417
For sale	29,249	856,198	27,280	853,722
Sulphite fiber, bleached, total	740,812	42,307,825	839,953	62,152,903
For consumption[3]..	470,904	26,706,195	549,685	37,719,011
For sale	269,908	15,601,630	290,268	24,433,892
Sulphite fiber, unbleached, total ..	676,711	28,053,795	841,558	40,812,205
For consumption[3]..	529,599	23,096,904	678,794	32,979,824
For sale	147,112	4,956,891	162,764	7,832,381
Sulphate fiber, total..	1,033,439	28,839,604	918,084	37,173,860
For consumption[3]..	971,148	27,055,226	801,881	32,563,810
For sale	62,291	1,784,378	116,203	4,610,050
Soda fiber, total.....	374,054	20,960,628	520,729	34,064,784
For consumption[3]..	283,347	16,002,686	397,731	26,156,655
For sale	90,707	4,957,942	122,998	7,908,129
Semichemical[4]	86,628	1,220,859	40,481	797,645
Screenings, mechanical[4]	10,115	96,256	11,459	144,718
Screenings, chemical, total	38,345	595,843	52,968	809,083
For consumption[3]..	21,932	292,676	37,335	525,924
For sale	16,413	303,167	15,633	283,159
Other pulp, total[5].....	69,849	8,759,273	74,350	11,581,324
For consumption[3]..	34,706	3,672,862	45,234	6,164,006
For sale	35,143	5,086,411	29,116	5,417,318

[1] Conduit pipes and cores, tannic acid, turpentine, wood flour, etc.

[3] Wood pulp made and consumed in the same plants or transferred to and consumed in other plants operated by the same companies.

[3] Item "For consumption" includes data for a small quantity of semichemical and of mechanical screenings for sale. (See footnote 4.)

[4] Practically all for consumption but includes a small quantity for sale, not shown separately to avoid disclosing approximations of data reported by individual establishments.

[5] Principally cottonseed-hull-fiber pulp, cotton-linters pulp, rag pulp, and reclaimed paper pulp.

TABLE 2.—WAGE EARNERS, BY MONTHS, FOR THE PULP INDUSTRY, FOR THE UNITED STATES, 1931, 1929, AND 1927, AND FOR STATES, 1931

[This table presents statistics for only those States for which figures can be given without disclosing, exactly or approximately, data for individual establishments. The sum of the State items in any column is not, therefore, equal to the United States total at the head of the column. The month of maximum employment is indicated by **bold-faced** figures and that of minimum employment by *italic* figures. See sec. 7, p. IV.]

	Average number employed during year	Number Reported for— January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
United States													
1931	20,219	20,349	20,778	20,769	**20,944**	20,825	20,491	20,367	20,027	19,678	19,738	19,539	*19,122*
1929	24,729	24,384	24,545	25,088	25,148	25,196	**25,336**	24,827	24,834	24,437	24,384	24,337	*24,235*
1927	24,794	25,199	25,250	**25,718**	25,486	24,998	25,062	24,543	24,432	24,147	*24,024*	24,285	24,378
States, 1931													
Louisiana	847	807	875	942	828	816	774	960	**988**	779	961	831	*597*
Maine	3,134	3,309	**3,310**	3,212	3,192	3,275	3,284	3,189	3,067	3,093	2,922	2,911	*2,845*
Massachusetts	209	209	212	**216**	214	214	214	212	208	204	204	201	*200*
Michigan	685	*653*	660	668	**736**	701	679	664	674	676	691	698	719
Minnesota	495	*412*	413	489	511	480	541	**567**	505	*447*	484	553	534
New York	2,022	2,019	1,975	2,136	**2,192**	2,115	1,916	2,006	2,044	2,051	1,964	1,940	*1,911*
Oregon	704	754	757	787	739	**806**	773	663	606	*605*	612	610	738
Pennsylvania	1,105	1,099	**1,190**	1,136	1,077	1,096	1,086	1,103	1,068	1,128	1,140	1,087	*1,051*
Tennessee	515	540	512	503	**498**	482	*450*	489	504	519	560	561	**562**
Vermont	75	*57*	62	62	86	88	79	67	67	67	83	**90**	88
Virginia	1,299	*1,184*	1,220	1,290	1,329	1,344	**1,356**	1,324	1,333	1,346	1,331	1,308	*1,226*
Washington	2,155	2,016	2,106	*2,014*	**2,250**	2,299	**2,311**	2,245	2,195	2,067	2,048	2,152	*2,154*
Wisconsin	2,807	**2,945**	2,924	2,886	2,844	2,785	2,782	2,757	*2,699*	2,741	2,778	2,794	*2,748*

TABLE 4.—EQUIPMENT, BY KIND, NUMBER, AND CAPACITY, FOR THE PULP INDUSTRY: 1931 AND 1929

Kind	1931 Number	1931 Capacity—tons (2,000 pounds) Per 24 hours	1931 Capacity—tons (2,000 pounds) Per year (310 days)	1929 Number	1929 Capacity—tons (2,000 pounds) Per 24 hours	1929 Capacity—tons (2,000 pounds) Per year (310 days)
Grinders	1,047	7,524	2,332,440	[1] 1,161	[1] 7,587	[1] 2,351,970
Digesters:						
Sulphite-fiber	349	6,115	1,895,650	385	6,357	1,970,670
Soda-fiber	185	1,751	542,810	198	2,037	631,470
Sulphate-fiber	183	4,224	1,309,440	[1] 113	[1] 2,740	[1] 849,400
Cotton linters, rags, etc.	32	379	117,490	27	286	88,660
Semichemical	25	344	106,640	13	191	59,210

[1] Revised.

Paper

This industry embraces establishments engaged primarily in the manufacture of paper and paperboard. The principal material used is wood pulp, the greater part of which is manufactured in pulp mills operated in conjunction with the paper mills. Small quantities of pulp made from rags, waste paper, straw, and other fibers of various kinds are also used.

At censuses prior to that for 1927 the manufacture of pulp and the manufacture of paper were combined under a single industry classification, "Paper and Wood Pulp."

TABLE 1.—SUMMARY FOR THE PAPER INDUSTRY, FOR THE UNITED STATES, 1931, 1929, AND 1927, AND FOR STATES, 1931

[Statistics are given for all States for which separate figures can be published without disclosing, exactly or approximately, the data reported by individual establishments. Certain of the "Other States," however, are more important in the industry than some of the States shown separately.]

	Number of establishments	Wage earners (average for the year)	Wages	Cost of materials, fuel, and purchased electric energy	Value of products	Value added by manufacture [1]
United States						
1931	[2] 650	87,683	$104,041,810	$384,420,395	$684,971,197	$300,550,802
1929	[3] 685	103,320	140,398,374	574,607,978	967,186,026	392,578,048
1927	[3] 710	98,566	130,474,739	572,785,538	919,891,465	347,105,927
Per cent of increase or decrease (—):						
1929-31	—5.1	—15.1	—25.9	—33.1	—29.2	—23.4
1927-29	—3.5	4.8	7.6	.3	5.1	13.1
States, 1931						
California	11	1,556	$2,097,405	$6,102,593	$11,692,087	$5,589,494
Connecticut	27	1,738	2,066,249	4,800,017	9,800,117	5,000,100
Delaware	6	404	430,292	1,483,951	2,315,857	831,906
Illinois	25	3,092	3,658,423	10,592,494	20,171,738	9,579,244
Indiana	21	1,586	1,759,871	5,638,605	10,108,684	4,470,079
Louisiana	9	1,060	1,166,895	8,234,927	13,620,587	5,385,660
Maine	26	6,992	8,671,585	40,899,011	67,792,075	26,893,064
Maryland	6	1,135	1,124,342	4,518,339	6,935,730	2,417,391
Mass.	74	10,443	11,741,952	27,151,552	56,958,778	29,807,226
Michigan	39	9,112	11,283,350	37,363,312	67,466,585	30,103,273
Minnesota	8	1,177	1,629,623	8,705,985	13,015,073	4,309,088
New Hamp.	21	1,828	2,115,855	9,393,448	13,964,713	4,571,265
New Jersey	36	3,763	4,669,048	12,138,022	25,382,019	13,243,997
New York	120	10,987	13,578,720	53,082,256	90,514,807	37,432,551
Ohio	48	8,343	9,949,400	32,448,119	56,823,967	24,375,848
Oregon	6	1,229	1,410,451	6,377,862	13,623,563	7,245,701
Pennsylvania	51	6,270	7,420,321	31,278,491	53,579,374	22,300,883
Tennessee	6	545	660,540	2,689,733	4,500,788	1,811,055
Vermont	10	745	1,250,897	3,381,174	5,505,657	2,124,483
Virginia	10	1,674	1,706,402	12,072,230	16,847,715	4,775,485
Washington	13	1,901	2,586,460	10,081,909	26,531,779	16,449,870
West Va.	6	596	667,563	2,229,900	4,004,048	1,774,148
Wisconsin	45	8,596	9,748,544	42,159,906	70,182,440	28,022,534
Other States [4]	26	2,911	2,647,622	11,596,559	23,633,016	12,036,457

[1] Value of products less cost of materials, fuel, and purchased electric energy. See sec. 10, p. IV.

[2] The 650 establishments reporting for 1931 operated 666 individual mills, combined reports having been made in a number of cases for 2 or more mills operated by a single establishment. The numbers of mills reported for individual States are identical with the numbers of establishments, with the following exceptions: Connecticut, 27 establishments, 28 mills; Iowa, 2 establishments, 3 mills; Maine, 26 establishments, 28 mills; Massachusetts, 74 establishments, 75 mills; Michigan, 39 establishments, 40 mills; New Hampshire, 21 establishments, 23 mills; New Jersey, 36 establishments, 37 mills; New York, 120 establishments, 123 mills; Pennsylvania, 51 establishments, 52 mills; Wisconsin, 45 establishments, 48 mills.

[3] The 685 establishments reporting for 1929 operated 702 individual mills, combined reports having been made in a number of cases for 2 or more mills operated by a single establishment. For 1927 the numbers of establishments and the numbers of mills are identical.

[4] Alabama, 3 establishments; Arkansas, 1; Colorado, 1; District of Columbia, 1; Florida, 1; Georgia, 2; Iowa, 2; Kansas, 3; Mississippi, 2; Missouri, 2; North Carolina, 4; Rhode Island, 1; South Carolina, 2; Texas, 1.

TABLE 3.—PAPER AND PAPERBOARDS—PRODUCTION, BY KIND, QUANTITY, AND VALUE, FOR THE UNITED STATES: 1931 AND 1929

Kind	1931 Tons (2,000 pounds)	1931 Value	1929 Tons (2,000 pounds)	1929 Value
1. Paper industry, all products, total	.....	$684,971,197	.....	$967,186,026
Paper and paperboard:				
2. Produced for sale	6,939,706	498,202,661	8,331,297	715,145,798
3. Produced for transfer to other plants of same company	1,259,025	65,118,228	1,612,554	101,878,865
4. Products other than paper and paperboard (not normally belonging to the industry)	.....	121,650,308	.....	150,161,363
5. Paper and paperboard produced for use in same plant	1,183,109	67,785,320	1,196,384	86,276,477

TABLE 2.—WAGE EARNERS, BY MONTHS, FOR THE PAPER INDUSTRY, FOR THE UNITED STATES, 1931, 1929, AND 1927, AND FOR STATES, 1931

[This table presents statistics for only those States for which figures can be given without disclosing, exactly or approximately, data for individual establishments. The sum of the State items in any column is not, therefore, equal to the United States total at the head of the column. The month of maximum employment is indicated by **bold-faced** figures and that of minimum employment by *italic* figures. See sec. 7, p. IV.]

	Average number employed during year	Number Reported for January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
United States													
1931	87,683	88,717	**89,836**	89,620	89,613	88,588	87,791	87,682	88,043	86,547	86,596	85,436	*83,731*
1929	103,320	*102,082*	103,231	103,311	102,809	102,847	103,614	103,508	104,241	104,036	**104,309**	103,489	102,362
1927	98,566	98,643	98,973	**99,291**	98,609	98,084	*97,847*	98,101	98,801	98,687	98,711	98,972	98,072
States, 1931													
California	1,556	1,566	**1,585**	1,576	1,569	1,576	1,581	1,554	1,582	1,583	1,522	1,511	*1,464*
Connecticut	1,738	1,800	**1,846**	1,799	1,778	1,762	1,742	1,718	1,694	1,682	1,684	1,696	*1,661*
Delaware	404	451	**478**	437	412	430	391	398	427	365	419	356	*286*
Illinois	3,092	3,169	3,193	3,218	3,115	3,120	3,132	3,110	**3,221**	3,080	3,066	2,907	*2,775*
Indiana	1,586	1,564	1,562	1,675	1,547	*1,379*	1,535	1,661	1,663	1,637	**1,713**	1,594	1,506
Louisiana	1,060	1,106	1,150	1,039	1,072	874	926	1,286	**1,290**	863	1,215	1,115	*780*
Maine	6,992	7,200	**7,251**	7,111	7,176	7,127	7,149	7,084	7,022	6,850	6,720	6,627	*6,590*
Maryland	1,135	*1,090*	1,150	1,151	1,147	1,148	1,109	1,120	1,120	1,108	**1,222**	1,134	1,120
Massachusetts	10,443	10,745	10,892	**10,928**	10,859	10,706	10,350	*9,900*	10,170	10,187	10,151	10,243	10,181
Michigan	9,112	9,136	9,330	9,222	9,438	**9,534**	9,281	9,394	9,300	8,819	8,840	8,775	*8,280*
Minnesota	1,177	1,148	1,174	1,235	**1,305**	1,145	1,099	1,078	1,206	*1,041*	1,239	1,196	1,255
New Hampshire	1,828	1,813	1,858	1,852	**1,867**	1,803	1,815	1,806	1,818	1,861	1,833	*1,798*	1,810
New Jersey	3,763	3,725	3,737	3,756	3,746	3,780	3,824	**3,840**	3,804	3,814	3,745	3,776	*3,606*
New York	10,987	11,293	**11,351**	11,299	11,286	11,145	10,779	10,786	10,864	10,818	10,815	10,727	*10,677*
Ohio	8,343	8,467	8,439	8,510	**8,571**	8,485	8,476	8,412	8,249	8,369	8,205	7,969	*7,962*
Oregon	1,229	1,209	1,205	*1,125*	1,160	1,165	**1,310**	1,292	1,295	1,267	1,249	1,220	1,254
Pennsylvania	6,270	6,333	6,319	6,360	**6,390**	6,364	6,294	6,208	6,201	6,263	6,271	6,189	*6,043*
Tennessee	545	538	554	549	537	551	**558**	544	537	552	545	546	*531*
Vermont	745	**789**	774	770	738	739	743	733	733	718	*715*	756	738
Virginia	1,674	1,713	1,703	1,688	1,701	1,706	1,670	1,676	1,662	1,663	1,666	1,626	*1,614*
Washington	1,901	*1,825*	1,909	**1,988**	1,973	1,938	1,913	1,909	**1,920**	**1,895**	1,840	1,845	1,859
West Virginia	596	592	594	*580*	596	590	586	589	**618**	614	607	598	595
Wisconsin	8,596	**8,775**	8,708	8,693	8,614	8,540	8,574	8,658	8,631	8,545	8,508	8,487	*8,403*

Kind	1931 Tons (2,000 pounds)	1931 Value	1929 Tons (2,000 pounds)	1929 Value
Paper and paperboard, aggregate (sum of 2, 3, and 5) [1]	9,381,840	631,106,209	11,140,235	903,301,140
News print and similar papers, total	1,514,543	86,143,284	1,772,591	109,315,125
Standard news print:				
In rolls	1,174,532	61,953,541	1,373,612	78,388,893
In sheets	28,731	1,700,835	35,557	2,318,006
Hanging	85,974	5,800,106	101,002	7,293,931
Catalog	89,382	7,064,325	111,771	9,570,858
Poster, novel, news-tablet, lining, etc.	135,924	9,624,477	150,649	11,743,437
Book paper, total	1,208,674	120,282,799	1,497,912	168,271,655
Machine-finished, sized, and supercalendered	952,142	94,977,883	1,176,596	131,852,168
Body stock for coated paper	199,946	18,345,062	250,234	26,755,587
Lithograph	10,036	1,081,260	19,877	2,417,196
Offset	23,454	3,146,490	26,304	3,847,128
Other book paper	[3] 23,096	[2] 2,732,104	24,901	3,399,576
Cover paper	23,520	4,371,668	28,072	6,429,856
Writing paper (fine), total	487,598	77,865,416	607,590	113,223,595
100 per cent rag	11,614	7,088,021	17,397	11,143,620
50 per cent or more but less than 100 per cent rag	25,130	9,651,320	40,416	15,972,906
Less than 50 per cent rag	42,974	10,220,045	60,806	15,536,771
Sulphite bond	246,971	31,304,209	284,609	41,724,237
Other chemical wood-pulp writing papers	160,909	19,601,821	204,362	28,846,061
Wrapping paper, total	1,401,667	110,885,376	1,605,783	163,442,382
Unbleached sulphite wrapping	156,701	13,239,803	143,568	13,564,762
Bleached sulphite wrapping	28,473	3,070,984	25,207	3,101,407
Sulphite for bags	14,606	1,294,033	47,002	4,308,885
Kraft:				
For bags	346,629	22,480,058	[3] 846,468	[3] 79,911,121
Other	521,114	36,234,510		
Bogus and screenings	25,701	1,151,299	38,529	2,086,111
Greaseproof	10,774	1,755,817	7,965	1,607,935
Glassine	37,666	6,684,742	47,438	9,736,951
Heavy (mill wrappers, etc.)	41,336	1,865,479	63,238	3,423,428
Rope, jute, etc.	33,850	5,443,834	62,270	12,075,511
Ground wood and chemical manila	29,664	2,276,119	54,893	4,600,729
Tag board, light manila board, and pattern	35,200	3,270,206	30,616	3,503,586
Other wrapping paper [4]	119,953	12,118,492	238,589	25,521,956
Tissue paper, total	394,623	45,041,174	387,811	53,300,059
High-grade	57,409	10,155,353	63,834	15,307,089
Manila and No. 2 white	44,950	5,306,032	40,691	5,543,375
Napkin	22,610	2,974,738	29,536	4,138,515
Toilet	150,652	14,319,971	142,725	15,102,952
Towel	53,521	4,679,913	52,283	4,903,065
Waxing	65,481	7,605,167	58,742	8,305,063
Absorbent paper, total	76,592	14,774,037	90,800	16,972,984
Blotting	9,565	1,775,628	14,125	2,828,427
Matrix board	3,230	1,372,269	4,281	1,516,233
Matrix paper	876	179,407		
For vulcanized fiber	10,484	1,519,628	25,928	4,106,713
Filter	972	274,845		
For parchmentizing	22,007	3,080,249	46,466	8,521,611
Other absorbent paper	29,458	6,572,011		
Building papers, totals	395,359	18,129,372	659,178	39,375,990
Sheathing papers	26,341	791,407	52,205	2,214,947
Felts	318,827	14,003,836	540,166	32,544,935
Asbestos-filled and asbestos paper	44,002	3,010,647	66,807	4,616,108
Other building papers	6,189	323,482	39,311	5,227,977
Other paper	31,441	4,500,770		
Paperboards, total	3,847,823	149,112,313	4,451,187	227,741,517
Container boards:				
Liners:				
Kraft	495,766	18,498,067	1,108,852	55,212,515
Other	574,391	19,979,789		
Chip (plain and test)	552,016	14,828,307	785,199	27,865,152
Straw (for corrugated-container use)	281,619	8,848,911	361,486	16,085,279
Folding box boards (bending):				
Manila-lined (all lined boards)	604,460	24,476,622	590,523	30,869,321
Patent-coated	179,464	8,865,286	182,831	11,195,066
Other folding box boards (including shell and unlined boards)	121,786	4,604,892	217,931	11,085,633
Set-up box boards (nonbending):				
Chip and straw	260,833	7,192,992	325,111	11,753,491
News board	216,806	5,818,053	189,028	7,430,984
Other (including tube, egg-case filler, pasted news and pasted chip boards)	84,537	3,044,396	85,526	3,859,432
Binders' board	32,703	2,177,414	63,165	4,675,097
Cardboard:				
Bristol board	36,424	4,471,381	47,233	4,921,690
Other cardboard	37,678	3,574,517		
Leatherboard	26,715	2,581,467	24,228	2,942,498
Pressboard	4,000	822,828	11,901	2,480,486
Other boards	338,625	19,327,391	457,173	37,364,873

[1] Includes data for paper and paperboard used in the manufacture of converted paper products in the plants which produced the paper and paperboard, as follows: For 1931, 1,183,109 tons, valued at $67,785,320; for 1929, 1,196,384 tons, valued at $86,276,477.

[2] Includes data for "text paper," not shown separately to avoid disclosing approximations of data for individual establishments.

[3] Reported as follows: Sulphate for bags, 134,234 tons, valued at $11,411,650; kraft, 712,234 tons, valued at $68,499,471.

[4] Includes data for "vegetable and other imitation parchment," not shown separately to avoid disclosing approximations of data for individual establishments.

TABLE 4.—PAPER AND PAPERBOARDS—PRODUCTION, BY QUANTITY, AND VALUE, BY STATES: 1931 AND 1929

[Statistics are given for all States for which separate figures can be published without disclosing, exactly or approximately, the data reported by individual establishments. Certain of the "Other States", however, are more important in the industry than some of the States shown separately.]

State	1931 Quantity (ton, 2,000 pounds)	1931 Value	1929 Quantity (ton, 2,000 pounds)	1929 Value
United States	9,381,840	$631,106,209	11,140,235	$903,301,140
California	192,273	9,724,409	253,800	15,140,414
Connecticut	153,391	8,049,394	197,060	15,656,533
Delaware	20,873	2,315,857	39,366	4,817,327
Illinois	485,725	16,766,088	596,577	29,748,082
Indiana	234,422	10,089,448	348,769	18,120,354
Louisiana	295,005	13,613,164	273,574	18,041,807
Maine	956,385	65,481,800	1,061,384	87,021,341
Maryland	87,099	6,138,613	109,348	9,453,897
Massachusetts	405,861	55,388,300	562,462	91,044,282
Michigan	902,561	54,473,879	1,092,111	82,016,379
Minnesota	240,785	13,013,682	318,387	21,647,522
New Hampshire	130,027	13,259,242	195,547	22,206,610
New Jersey	498,301	23,986,027	604,940	37,074,136
New York	1,160,037	86,884,126	1,512,855	124,711,686
Ohio	788,912	50,667,907	936,572	72,284,788
Oregon	200,065	13,492,637	222,731	16,158,578
Pennsylvania	607,830	47,255,241	748,960	67,117,895
Tennessee	94,569	3,914,554	83,564	4,407,312
Vermont	65,676	4,835,673	72,677	6,763,124
Virginia	275,523	16,691,393	242,455	20,296,766
Washington	374,765	25,575,133	382,253	27,679,043
West Virginia	43,579	3,739,969	51,889	5,016,561
Wisconsin	727,032	63,727,147	886,146	85,240,423
Other States [1]	441,144	22,022,526	346,808	21,636,280

[1] See footnote 4, table 1, p. 15.

TABLE 5.—PAPER MACHINES, BY TYPE, NUMBER, AND CAPACITY, BY KIND OF PAPER MADE: 1931, 1930, AND 1929

Kind	Total capacity per year of 310 days (tons, 2,000 pounds)	Fourdrinier Number	Fourdrinier Capacity per 24 hours (tons, 2,000 pounds)	Cylinder Number	Cylinder Capacity per 24 hours (tons, 2,000 pounds)
Total:					
1931	13,971,700	928	23,295	744	21,775
1930	13,643,100	934	22,557	708	21,453
1929	13,704,480	937	22,131	738	22,077
Newsprint:					
1931	1,636,490	105	5,279	...	.....
1930	1,712,130	121	5,523	...	.....
1929	1,695,080	126	5,461	1	7
Book paper:					
1931	1,774,130	288	5,723	...	.....
1930	1,762,970	234	5,685	1	2
1929	1,774,750	239	5,691	4	34
Cover paper:					
1931	42,780	13	135	1	3
1930	106,330	19	313	4	30
1929	46,810	13	132	3	19
Writing paper:					
1931	803,830	168	2,587	1	6
1930	650,380	143	2,091	1	7
1929	623,410	143	1,984	2	27
Wrapping paper:					
1931	1,944,320	193	5,520	56	752
1930	2,058,400	222	5,970	64	670
1929	2,039,800	206	5,597	69	983
Tissue paper:					
1931	535,370	113	1,297	80	430
1930	437,410	109	979	87	432
1929	442,680	102	952	94	476
Absorbent paper:					
1931	139,810	36	404	22	47
1930	118,420	35	349	17	33
1929	148,800	36	369	16	111
Building papers:					
1931	884,740	5	245	68	2,609
1930	789,880	4	194	66	2,354
1929	911,090	5	230	72	2,709
Other:					
1931	414,780	52	1,278	8	60
1930	270,010	26	656	15	215
1929	325,190	38	973	7	76
Boards:					
1931	5,795,450	15	827	490	17,868
1930	5,737,170	21	797	453	17,710
1929	5,696,870	29	742	470	17,635

Clarke & Co. to Represent Louis Dejonge

Clarke & Company, 475 Fifth Avenue, New York, have been appointed general sales agents for all the surface coated papers manufactured by Louis Dejonge Company, Fitchburg, Mass.

Paper & Pulp Section National Safety Council To Meet at Cleveland, Ohio, October 1-4

With "Let's Tell the World About Safety" as their battle cry and official slogan, some 6,000 to 8,000 delegates will convene in Cleveland, Ohio, October 1 to 4 for the Twenty-third Annual Safety Congress and Exposition. They will represent industrial, educational, civic and official bodies from all parts of the United States and several foreign countries.

The official program, just issued by the National Safety Council, shows a total of 120 sessions and more than 350 speakers. Separate programs have been prepared for almost every branch of industry, thus making the Congress in effect a joint safety convention of some 30 different groups. In addition, sessions have been planned for school executives, street traffic authorities, and those interested in safety in the home. In order to complete this vast program in the short space of five days the facilities of three hotels will be taxed to the utmost, and it will be necessary at times to run as many as fourteen sessions concurrently. The Congress hotels are the Cleveland, the Carter and the Statler.

An outstanding feature of the meeting this year is a series of "Subject Sessions" planned and sponsored by the American Society of Safety Engineers—Engineering Section of the National Safety Council. These include "Fusion Welding and Cutting," "Mechanical Methods of Handling Materials," "Safe Use of Electricity in Industry," "New Workers," "Safe Use of Chemicals in Industry," "Dust in Industry," and "Why People Fall."

Leading Cleveland business establishments and civic organizations are busy with plans for a city-wide safety campaign during the week to synchronize with the Congress, and the city will be decorated for the occasion.

A model "Safety Town" will be set up in the main ballroom of the Statler Hotel and here will be seen scores of interesting and educational exhibits of industrial safety equipment. A public safety exhibit, featuring traffic control equipment, will be held in the Cleveland Hotel.

An interesting program has been prepared for the Paper and Pulp Section of the National Safety Council. It follows:

General Chairman, H. G. Gilson, Oxford Paper Company, Rumford, Maine.
Vice-Chairman in Charge of Membership, H. D. Banta, Hoberg Paper and Fiber Company, Green Bay, Wis.
Secretary and News Letter Editor, F. L. Irvin, St. Croix Paper Company, Woodland, Maine.

Monday Afternoon

Address of Welcome

2:00 Our Sectional Activities—Past, Present and Future—General Chairman H. G. Gilson.
2:30 Accident Prevention and the New Industrial Economy—Ernest W. Corn, Field Safety Counselor, F. E. R. A., Washington, D. C.
3:30 Discussion.

Tuesday Morning

9:45 Using Our Injury Records to Advantage (Illustrated)—R. I. Dickinson, Safety Director, Cornell Wood Products Company, Cornell, Wis.
10:10 Discussion.
10:30 Report of Accident Experience Exchange (Illustrated)—Ernest Augustus, Safety Director, Mead Corporation, Chillicothe, Ohio.
11:00 Discussion.
11:15 Safety Methods Adopted by the Consolidated Paper Corporation—J. H. Turner, Director of Safety, Consolidated Paper Corporation, Ltd., Grand 'Mere, P. Q., Canada.
11:45 Discussion.

Tuesday Luncheon

1. Presentation of 1933-34 Safety Contest Awards.
   (a) National Safety Council Trophies
   By a National Safety Council Officer.
   (b) The Paper Industry Trophy
   E. B. Fritz, Publisher, *The Paper Industry.*
2. Election of Officers.

Wednesday Morning

9:45 Safety Exchange Round Table.
An open forum on paper and pulp mill safety problems—Conference Leader: H. T. Randall, Works Eng., The Champion Coated Paper Company, Hamilton, Ohio.

Thursday Morning

9:45 Trend of Occupational Diseases and Compensation in the Paper Industry—Dr. A. G. Cranch, Medical Director, National Carbon Company, Cleveland.
10:15 Discussion.
10:30 Putting Safety Engineers Under the Microscope—W. Graham Cole, Director of Safety, Metropolitan Life Insurance Company, New York City.
11:30 Discussion.

Ball Bros. Acquire Cornstalk Plant

MUNCIE, Ind., September 10, 1934—Acquisition of the plant of the Cornstalk Products Company at Danville, Ill., formerly makers of paper from cornstalks and the pioneer company in the country to make such an attempt, by Ball Brothers Company, makers of fruit jars here, has been announced by George A. Ball. The company will announce definite details concerning operation of the Danville plant shortly.

The company at the present time maintains a factory at Noblesville, Ind., for the manufacture of cartons in which its products are shipped.

"The Cornstalk Products Company was organized in 1928 to produce paper making pulp from cornstalks, manufacturing paper and paper products," Mr. Ball said. "We expect it to be of importance to the farmers in the utilization of farm wastes. This plant probably will become an important addition to our new paper department. eW already have two mills at Noblesville and Eaton, Ind., now utilizing farm wastes."

Brown Appoints New Distributor

[FROM OUR REGULAR CORRESPONDENT]

HAVERHILL, Mass., September 10, 1934—Edmund Little Company, of 20 Fleet street, this city, has recently been appointed distributor of Nibroc twine and towels for the Brown Company of Portland, Me.

Paper Industry Will Move to the South, Says Alabama Power Official

AUBURN, Ala., September 8, 1934.—The newsprint paper industry is on the point of migrating to the South and will be followed by a long line of other paper and chemical industries, Thomas W. Martin, president of Alabama Power Company, told the annual farmers' meeting at Auburn Monday morning.

Calling attention to the unemployment, reduced purchasing power, lowered price levels of farm and factory products, loss in taxes to maintain our schools and other public agencies brought about by the depression, Mr. Martin declared development of new industries to overcome these conditions is the most important task facing the people of Alabama today.

The establishment of mills in Alabama to make newsprint and other paper out of Southern pine offers the best immediate prospect of doing so, Mr. Martin said, adding that it is fitting that this discussion should take place at Auburn under the auspices of Alabama Polytechnic Institute, a college that does not hold itself aloof but realizes that it has a service to perform to the man in the street, the field and the forest.

Market Discussed

Something of the market for paper products was given by Mr. Martin when he pointed out that during the past four years the imports of white paper and paper base stocks into the United States have amounted to an average of more than $170,000,000 per year, over 70 per cent of our yearly consumption of newsprint. Only one-third of the 3,000,000 tons of newsprint used in the United States in 1933 was manufactured in this country, he added, and 80 per cent of the wood used in making this 1,000,000 tons was imported. This left but 7 per cent of the newsprint to be made from United States wood.

"In the past the South has consumed but a fraction of its timber," Mr. Martin continued. "The great pine forests of the South are gone—converted elsewhere and returned to the South as finished products. It has been so with many of the products of the South,—cotton, coal, ore, etc. They were shipped in crude form to other parts of the nation to be processed and then returned for our use."

Mills Needed

The Alabama farmer's interest in this program to develop a papermaking industry in the South lies, Mr. Martin declared, not only in the new cash crop of $3.50 to $5 for pulpwood which it would bring to every farmer with a wood lot, but the 8 to 10 times that amount which it would pay out largely in the community in the form of wages, salaries, coal power, lime, sulphur and other materials.

"We have seen the first fruits of this program in the making of Kraft paper products from Southern cut-over and second-growth pine," continued Mr. Martin, "Southern plants, three of the largest of which are located in our area at Tuscaloosa, Mobile and Panama City, now produce over 50 per cent of the nation's requirements.

"But as Dr. Stewart J. Lloyd, of the University of Alabama, recently pointed out, in Kraft paper manufacture, over half of the pine log now becomes paper, the other half being burned. This half, Dr. Lloyd predicts, will in a few years be converted into a bewildering variety of chemical products.

"Now through the efforts of Dr. Charles H. Herty, aided by citizens of Savannah and the Chemical Foundation of New York, the use of Southern pine in newsprint manufacture has been made practicable, and the South is ready for the establishment of a great white paper products industry."

Quick Growth

The greatest advantage of the South for the manufacture of paper is its ability to grow pulpwood in from 10 to 15 years, Mr. Martin declared. This compares, he said, with the 45 to 70 years required to replace a tree in the cold climate from which come the greater part of the wood for paper making.

But, he pointed out, this and other advantages exist not only in the coastal plain areas of Middle and South Alabama but in equivalent sections of South Carolina, Georgia, Mississippi, and portions of Louisiana, Texas and Florida.

Among the practical questions that Mr. Martin said are asked by "those who would locate in the South,—and we have had a number of discussions with them in recent months,—are 'What about wood supply?' 'Is it available near centers of production in sufficient volume, so that the cost of manufacture will compare with that of existing mills in the North and in Canada,' 'Is electric power and coal available near the wood supply?' And one other important question was asked me a few days ago,—'Will capital so invested receive fair and reasonable treatment?'

"These are factors which enter into the location of this industry, and it is significant that many of those who are inquiring have come to the conclusion that Alabama presents more natural advantages than any other state in the South."

Concluding, Mr. Martin said: "Here we have visions of another major industrial development. It means jobs for thousands of our unemployed; a profitable outlet for a cheap and abundant raw material—wood—which will be purchased for cash from farmers and other land owners. It means great markets for coal and lime and other products, and finally increasing population, wealth and new taxable property.

"Let the South see to it that it makes a permanent home for the industry by wise legislation and public policies that insure fair treatment to those who invest their capital amongst us and by insuring perpetual supplies of pulpwood; else the South in her turn may see the industry again move to some other country whose forests flourish and regrow with even greater luxuriance than in our own country."

Strike Does Not Affect Felt Mills

[FROM OUR REGULAR CORRESPONDENT]

RENSSELAER, N. Y., September 10, 1934—The nation-wide strike of textile workers has had no effect as yet upon activities at the mills of the Albany Felt Company and F. C. Huyck & Sons. It is said that the employees are not fully organized and both concerns look for no cessation in operations. Officials of the Albany Felt Company reported work as usual with no prospect of any trouble. The company operates under the open shop system and only a minimum of union labor is to be found in the ranks of employees.

CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Finances and Operation of Paper Mills

Construction News

Newark, N. J.—Newton Carton Company, Ferry and St. Francis streets, manufacturer of paper boxes and containers, has leased a one-story factory at 27 Haynes avenue, formerly used as a leather tannery, and will remodel and equip for a new plant. Present factory will be removed to new location and additional machinery provided for increased output. Company was formerly located at Newton, N. J., and is now concentrating production in Newark.

St. Joseph, Mo.—The American Paper Stock Company is planning early rebuilding of portion of local storage and distributing plant, recently damaged by fire. An official estimate of loss has not been announced.

New Haven, Conn.—The Fitzhugh-New Haven Corporation, recently organized with capital of $50,000, will operate a local plant for the manufacture of folding paper boxes and other containers. New company is headed by William W. Fitzhugh, 68 Cambridge place, Brooklyn, N. Y., and Alexander A. McCurry, Forest Hills, N. Y.

Boston, Mass.—The Atlantic Paper Box Company, 43 Haverhill street, manufacturer of paper boxes and containers, has leased a floor in building at 40 Waltham street, extending to 1359 Washington street, as well as two additional floors in the last noted structure, and will occupy for new local plant. It is understood that present establishment will be removed to new location and considerable increased capacity arranged.

Harrison, N. J.—The Reynolds Metals Company, 19 Rector street, New York, N. Y., manufacturer of foil surface papers, tin foils, etc., has work under way on remodeling and improving former local plant of the Edison Lamp Works, Inc., Cross street and Kingsland avenue, acquired a few months ago, as reported in these columns at that time, and will have plant ready for service at an early date. The entire property consists of a group of eight two and three-story buildings. Reynolds company will develop the plant as its main Eastern works, providing equipment and facilities for large capacity. Company will continue plants at Louisville, Ky., Chicago, Ill., and San Francisco, Cal., as heretofore. New Harrison works are reported to represent an investment of more than $400,000.

Waterville, Me.—The Keyes Fibre Company, Inc., operating a wood pulp mill at Shawmut, Me., is arranging plans for reorganization, and has filed application in the Federal Court at Portland, Me., to proceed with such a program under the new Federal law. Following, the company proposes to carry out increased operations at mill.

Dayton, Ohio—The Central Ohio Paper Company, 131 East Sixth street, has deferred award of contract for extensions and improvements in local storage and distributing building, location noted, pending a decision to proceed with such program or to construct a new building on the site. As previously reported in these columns, improvement work was estimated to cost approximately $20,000, with equipment. Harry G. Allen and Howard T. Collingwood, Grand Theater Building, Columbus, Ohio, are architects for company.

Buffalo, N. Y.—The Shipping Container Corporation, recently organized with capital of $10,000, is said to be planning early operation of local converting plant for manufacture of corrugated and other cardboard containers for general shipping service. Incorporators of new company include M. H. Odell, 215 Ashland avenue, and Robert Braunlein, 56 Orange street, both Buffalo.

Marcus Hook, Pa.—Congoleum-Nairn, Inc. Marcus Hook, manufacturer of hard-surfaced composition flooring, etc., with headquarters at Kearny, N. J., has awarded general contract to the Turner Construction Company, Architects Building, Philadelphia, Pa., for extensions and improvements in local mill. Estimated cost about $50,000, with equipment.

New York, N. Y.—The Ever Ready Label Corporation, 257 West 17th street, manufacturer of paper labels and kindered paper goods, has arranged for removal of plant to building at 141-45 East Twenty-fifth street, where about 20,000 square feet of space will be occupied. Expansion will be carried out at new location.

Hoquiam, Wash.—The Grays Harbor Pulp and Paper Company is said to have plans completed for new addition to pulp mill and will proceed with project at early date. It will be equipped for a capacity of about 50 tons of sulphite pulp daily, providing a total output of 200 tons per day at the plant. New unit is reported to cost close to $100,000, with machinery.

Saimen Lake, Finland—The Enso-Gutzeit Company and the Tornator Company, Ltd., London, England, affiliated interests, have plans maturing for a new mill at Saimen Lake for the production of sulphate cellulose. It will consist of several units, to be equipped for initial capacity of about 80,000 tons per annum, with power house, pumping plant, machine shop and other mechanical departments. New plant is reported to cost over $500,000, with machinery.

Izmid, Turkey—The Ministry of Industries, Istanbul, has approved plans for early construction of new Government-owned paper and pulp mill at Izmid, where large tract of land has been taken over for this purpose. New plant will comprise group of mill buildings, with power station and other mechanical units. It will be equipped for an initial rating of about 35 tons of paper per day, and is estimated to cost over $750,000, with

machinery. New plant is scheduled for completion early next year.

Markinch, Scotland—The Fife Paper Mills, Ltd., operated by Tullis, Russell & Co., Ltd., have recently begun the manufacture of a line of heavy paper bags and sacks for cement, salt, coke and other materials, and plan to develop large capacity in this new line. Present type and size bags will be increased with other bag units at early date, with larger capacity at the plant.

New Companies

Cleveland, Ohio—The Great Lakes Box Company has been incorporated with capital of $90,000 to manufacture and deal in paper boxes and other kindred containers. The incorporators include R. L. McNally and Frank C. Manak, Jr. Company is represented by Simmons, DeWitt & Vilas, Fidelity Building, city, attorneys.

Los Angeles, Cal.—Standard Bag Corporation has been chartered with capital of $25,000, to manufacture and deal in paper bags and containers. The incorporators include Gordon M. Wilce and Wilbur A. Reid, Alhambra, Cal. Company is represented by Howard A. Grant, 325 West Eighth street, Los Angeles.

Trenton, N. J.—The Trent Paper and Stock Company, has been incorporated with capital of 100 shares of stock, no par value, to deal in paper products. New company is represented by Irving H. Lewis, American Mechanics Building, Trenton.

Ontario Paper Mills Fairly Active

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 10, 1934—Wholesale paper circles in Ontario are emerging from the influence of the holiday season and sales are gradually increasing. While there is no big movement as yet, improvement is noted in the market for both fine and coarse papers and there is a feeling that the fall months will produce some very good business. There is a slightly better demand for books, bonds and ledgers from the printing trade, especially lithographic circles, and the whole tone of the market for fine papers has undergone some improvement during the past week or two. Coarse papers are somewhat slower in their come-back but a slight improvement in demand is also seen in this section, although the paper bag market is still somewhat slow. In paper converting circles some weeks of better business during the latter part of July and part of August have been succeeded by quiet conditions again and the call for envelopes, blank books and general stationery lines has fallen off materially.

Mill trade continues fairly active and while most of the plants have few orders ahead enough business is coming into the fine paper mills to keep the machines operating, although on a shortened schedule. With none of the consuming sources stocking up to any extent sales staffs of the paper manufacturing industries have to be content with small orders for future delivery, most of them concentrating on tonnages for current handling. Some of the mills report that they are booking more orders for finer grades of paper than has been the case for some time and it is a fact that the call for coated stock is greater just now than it has been for months. This can hardly be termed a general condition as some plants report that the call is still is for the cheaper grades. A nice business is being done by the light weight paper manufacturers in the face of some competition from the United States and the general condition of this section of the paper trade is one of prosperity. In paper box circles throughout Ontario the set-up box trade is quiet but a fair amount of manufacturing is being done by the folding box trade.

EAU CLAIRE PAPER MILL STARTS

(*Continued from page 9*)

from her the true value of Kimberly-Clark stock purchased from her. Her contentions were based largely on the valuation attached to the Kotex Company, a Kimberly-Clark subsidiary. The motions are on an attempt to have the answers of the jury changed by argument, thus reversing the decision. Failing that, the attorneys seek a reversal of judgment on the facts. The motions were taken under advisement by Judge Fred Beglinger, who heard the case.

Tribute to Robert L. Kraus

The following published tribute was paid by George W. Mead, president of the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., to Robert L. Kraus, vice president of the company, who died about a week ago:

"Mr. Kraus was identified with Consolidated Water Power and Paper Company from its very beginning. He was elected vice president and director in 1907 and conducted our stockholders' meetings every year without fail. No matter where or how busy he was, he never missed a meeting. He keenly sensed his responsibility as a representative of those who own our company, and they trusted his high business ability and his honest personality. His opinions were quietly expressed, and his decisions were made calmly and decisively."

News of the Industry

Nekoosa-Edwards Paper Company, Port Edwards, Wis., has received orders for 4,446 tons of lime sludge from farmers in the vicinity who will use it on sour soil. The hauling is to be done through arrangements by the county agricultural agent as an FERA project. The company has about 30,000 tons available, and expects to dispose of the entire amount by this method.

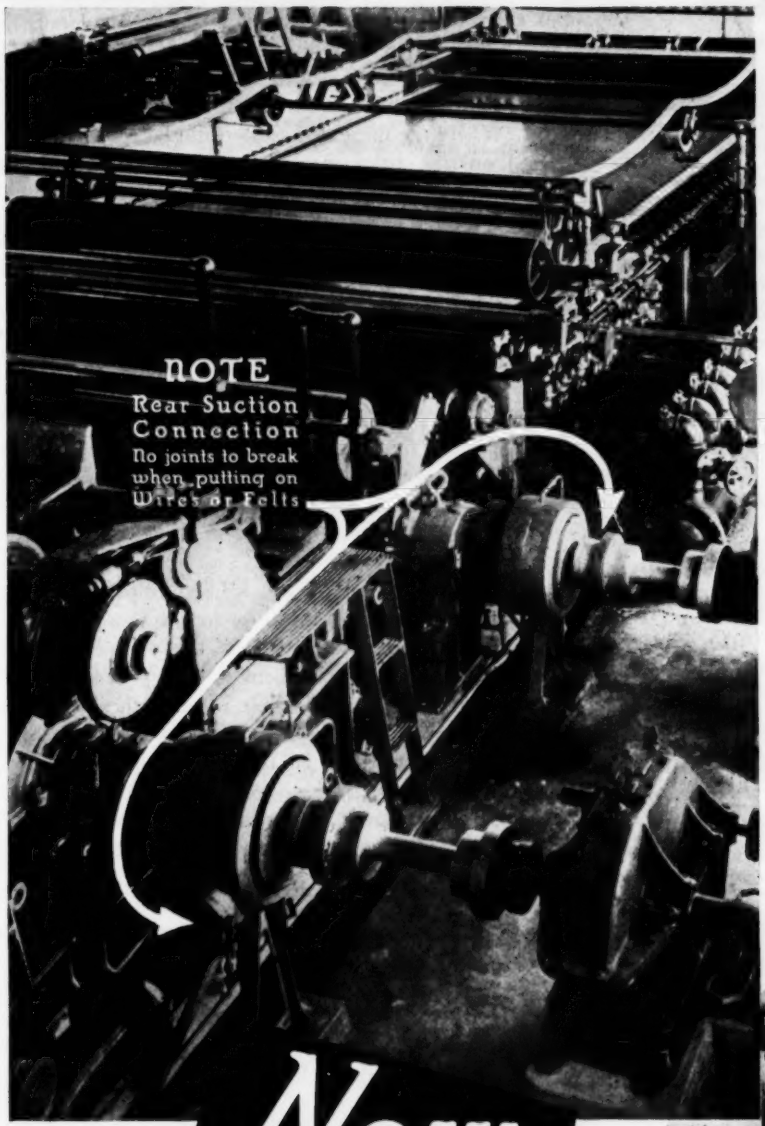
Serious damage was averted when a sulphur tank at the Interlake Pulp and Paper Company, Appleton, Wis., caught fire last week. The fire department extinguished the blaze before it made any headway.

Frank J. Schneller, second vice president and sales manager of the Gilbert Paper Company, Menasha, Wis., was elected president of the Conference Laymen's Association at the annual Wisconsin Methodist Conference at Appleton, Wis. He led a vigorous fight against a report of the Methodist Social Service Commission in which it condemned the "capitalistic" system in industry, pointing out that a known communist was the author.

George W. Mead, president of the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., spent September 7 and 8 at Rochester, N. Y., in company with Mrs. Mead, attending the fifth annual meeting of the Committee of One Hundred of Miami Beach, Florida. The committee is made up of prominent men from all over the country who have winter homes at Miami Beach, and has 385 members, including some of the country's most prominent industrialists. The visitors were guests at a dinner given by Frank Gannett, Rochester publisher.

William D. Kurz, who was superintendent of the first hydro-electric plant in the world, died at his home at Neenah, Wis., last week. The plant was located on the Fox River at Appleton, Wis., and the firm was known as the Edison-Appleton Light Company. Thomas A. Edison personally assisted in establishing the plant and had an interest in it. Mr. Kurz was twenty years of age when he operated the plant 52 years ago. Burial took place at Appleton.

DOWNINGTOWN



Rear Suction Identifies the MODERN Suction Roll

All Downingtown Suction Rolls (Couch, Press or Felt Cleaning) have REAR END SUCTION, making it unnecessary to break vacuum connections when changing wires or felts. Front end of the roll does not project into the machine aisle either at the floor or at the center of the roll. Mills without basements can run suction piping DIRECT to vacuum pump on floor at back of machine. This eliminates necessity of running suction piping under the pit from the front of the machine and then up to the pump on the floor.

DOWNINGTOWN MANUFACTURING CO., DOWNINGTOWN, PA.

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Herbert J. Laughton
Associate Editor

Thomas J. Burke, C. A.
Editor Cost Section

Lynne M. Lamm
Washington Correspondent

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COMING EVENTS

Paper and Pulp Section, National Safety Council, annual convention, Hotel Statler, Cleveland, Ohio, October 1-4, 1934.

AN ILL-ADVISED STRIKE

It is a distinct disappointment that it was not possible through the machinery of NRA to avoid the wide-spread textile strike. Chief among the union demands is a thirty-hour week with forty hours pay. This is an unreasoable demand. Obviously, as the *New York Times* states:

"It means a drastic rise in the expense of doing business. Mr. Richberg, in his recent report, asserted that between June, 1933, and June of this year the average work week had already been reduced approximately six hours, to thirty-seven hours a week, and that average hourly wages had been increased 26 per cent. The effect was to increase costs of production, and through this to raise prices. Some industries were affected much more than others. The spokesmen for the cotton garment industry, for example, have maintained that wages in their Northern mills were raised 55 per cent and in their Southern mills 85 per cent, and that the result has been an increase in the price of garments, mainly bought by working people, of 40 to 50 per cent.

"The adoption of a thirty-hour week would greatly aggravate these tendencies. Where it reduced existing hour standards from forty to thirty, it would mean a further increase of 33 1-3 per cent even in the present increased hourly wages. To look upon this as an 'increase in purchasing power' is to take the view of a bookkeeper who has account only of credits and never of debits. Whatever may be said for fiat wage increases on humanitarian grounds, it is obvious that employers lose by them exactly as much as the workers gain; there is no net increase in purchasing power whatever. Aside from this, an increase in wages means an increase in the expenses of doing business. Depending upon the nature of the demand for the particular commodity manufactured, it may or may not be possible to pass this increase on in higher prices. Where this cannot be done, the tendency of the increased wage rates would be to wipe out the marginal firms that had previously barely been making ends meet; this would mean the throwing of the men out of work and lessened employment. Where the increased costs could be wholly or partly passed on, the price increase would, on the one hand, tend to wipe out the worker's advantage from his wage increase, and on the other, to reduce the industry's volume of sales, and consequently the employment it could give.

"One further error of the shorter week theory is its assumption that the existing demand for industrial products is fixed. This overlooks that 'demand' is at bottom, reciprocal. Ultimately, for example, passing over the intervention of money, both employers and workers in the shoe business buy radios with shoes, and those in the radio business buy shoes with radios. But when hours are arbitrarily reduced by 25 to 30 per cent, this means a cut in production of nearly the same amount. When this cut in production occurs all around the circle, it reduces demand all around the circle, and the supposed compulsory increase in employment is likely to prove illusory.

"Finally, we cannot afford to forget the position we should be in if we did adopt the thirty-hour week and ever did secure full employment on that basis. It would probably be politically impossible to undo the 'emergency' measure. For it would be maintained that an increase in hours to forty a week—a 33 1-3 per cent increase—would automatically throw 25 per cent of the workers out of jobs. Moreover, any attempt to repeal the allegedly temporary increase in hourly wage rates would be resisted to the last ditch. In that case we should find ourselves frozen at a lower lever of production."

Rioting, violence and death have already featured the strike. The story of its progress in the daily press does not make pleasant reading. Plainly, public sympathy is not with the strikers and under such circumstances, if we may judge the future by the past, the strike, so far at any rate as the major demands of the union are concerned, is not likely to succeed.

GETS PAPER FELLOWSHIP

Dr. Edward R. Weidlein, director of Mellon Institute, Pittsburgh, has announced that Marc Darris has been appointed to fill a newly created industrial fellowship for research on paper milk bottle caps, bottle closures, and the study and improvement of paper packages for food and dairy products.

The fellowship was established by the Toledo Bottle Cap Company of Toledo. Darris, a graduate of the University of Washington, has been at Mellon Institute since 1916, when he received the Koppers Company fellowship.

Ask Paper Code Modification

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 12, 1934.—The paper and pulp industry, through its code authority, has submitted an application to NRA for modification of its code by amending it as follows:

Pursuant to Section 5 of Article IX of the Code of Fair Competition for the Paper and Pulp Industry, as approved by the President on November 17, 1933, it is requested that Section 5 of Article VII of said Code be amended to read as follows:

"Except in fulfillment of bona fide contracts existing on the effective date of this Code, no member of the industry shall sell *or offer for sale* any products of the industry for domestic consumption at a price or prices lower than or upon terms or conditions more favorable than stated in his price schedule filed as hereinbefore provided."

NRA has given official notice that any criticism or objection to such modification should be submitted to Deputy Administrator David H. Tulley prior to September 15 and that "said modification may be approved in the form now submitted and/or in such form, substance, wording and/or scope as it may be modified and/or amplified on the basis of criticisms, objections or suggestions submitted and supporting facts received pursuant to this notice or other information or consideration properly before the Administrator.

"Any person submitting any such criticism, objection or suggestion must state his name, the persons or groups whom he represents, and the facts supporting his criticism, objection or suggestion. All matter submitted will be given due consideration and the Administrator will act only after consulting with such of his advisers as he may deem appropriate."

Loan to Florida Pulp Mill Denied

A press dispatch from Rockland, Me., states that "Representative Edward C. Moran, Jr., said today he had been notified from Washington that an application of the Kraft Pulp and Paper Company of Fernandina, Fla., for a PWA construction loan had been finally rejected.

"The application several months ago of the Florida mill for a $5,500,000 loan drew the opposition of Maine's Congressional delegation and Gov. Louis J. Brann.

"They strongly objected to PWA Administrator Ickes that granting of such a loan 'would violate sound business judgment, tend to destroy a Maine industry and defeat the ultimate goal of the New Deal.'

"They charged that establishment of the Fernandina plant with government funds would be in direct competition with the pulp and paper industry in Maine which employs more than 10,000.

"The Florida application followed the announcement of Dr. Charles H. Herty, Atlanta, Ga., scientist, that he had discovered a method whereby southern white pine could be made into pulp at much less cost a ton delivered at New York than a similar product from Maine."

Box Plant to Remain in Warsaw

[FROM OUR REGULAR CORRESPONDENT]

WARSAW, Ind., September 10, 1934—E. P. Wagner, Chicago, vice-president of the Schultz-Illinois Star Paper Box Company, has written C. T. Simpson, manager of the local plant of the company, that the plant will remain here indefinitely in view of the fact that a large number of orders is being booked.

O. B. Andrews Co. Expands

CHATTANOOGA, Tenn., September 10, 1934—Expansion of the O. B. Andrews company's Knoxville branch from a warehouse and distributing facilities to a combination manufacturing and distributing plant was announced in Knoxville with the closing of a deal for a four-acre factory site on Kingston pike.

The opening of the factory there, described as "a single unit container plant," will mean the employment of fifty workers and the resultant loss of employment to about fifty workers from the main factory in Chattanooga.

An advantage of about 50 per cent in Knoxville's favor in electric power rates will not have a major bearing on the operation costs in the single unit plant being built, O. B. Andrews, president of the company, said. This difference would have a "tremendous bearing," however, if the company's $2,000,000 paper manufacturing plant were located in Knoxville, he declared.

The O. B. Andrews company manufactures paper, paper boxes and paper and cardboard toys and novelties. Its home office and main plant are located in Chattanooga, with branches in Knoxville, Atlanta and Houston.

The decision to put in a box container plant in Knoxville was attributed by Mr. Andrews to the rapid growth of business there. Heretofore, the company has had a warehouse and delivery trucks in that city, but the orders have been turned out by the big Chattanooga plant. The new Knoxville unit will now make boxes to fill all orders from upper East Tennessee and the Virginia and North Carolina territory. The site is ideally located on the Lee highway entering Knoxville and adjacent to the Southern railway. Its location on the west outskirts of the city is also convenient to access for executives from the home offices in Chattanooga making quick trips to the branch for supervisory purposes.

Announcement of the new branch factory was made by Mr. Andrews through W. K. McClure & Co., real estate agents, of Knoxville, with the statement that much of the machinery to be used will be specially designed and will not be ready before the last of the year. Purchase price of the site was not revealed. It was stated that employment at the new branch would be about fifty to sixty persons.

"But we expect a rapid growth in the Knoxville division and we anticipate employment of several times this number within the next two years," Mr. Andrews stated.

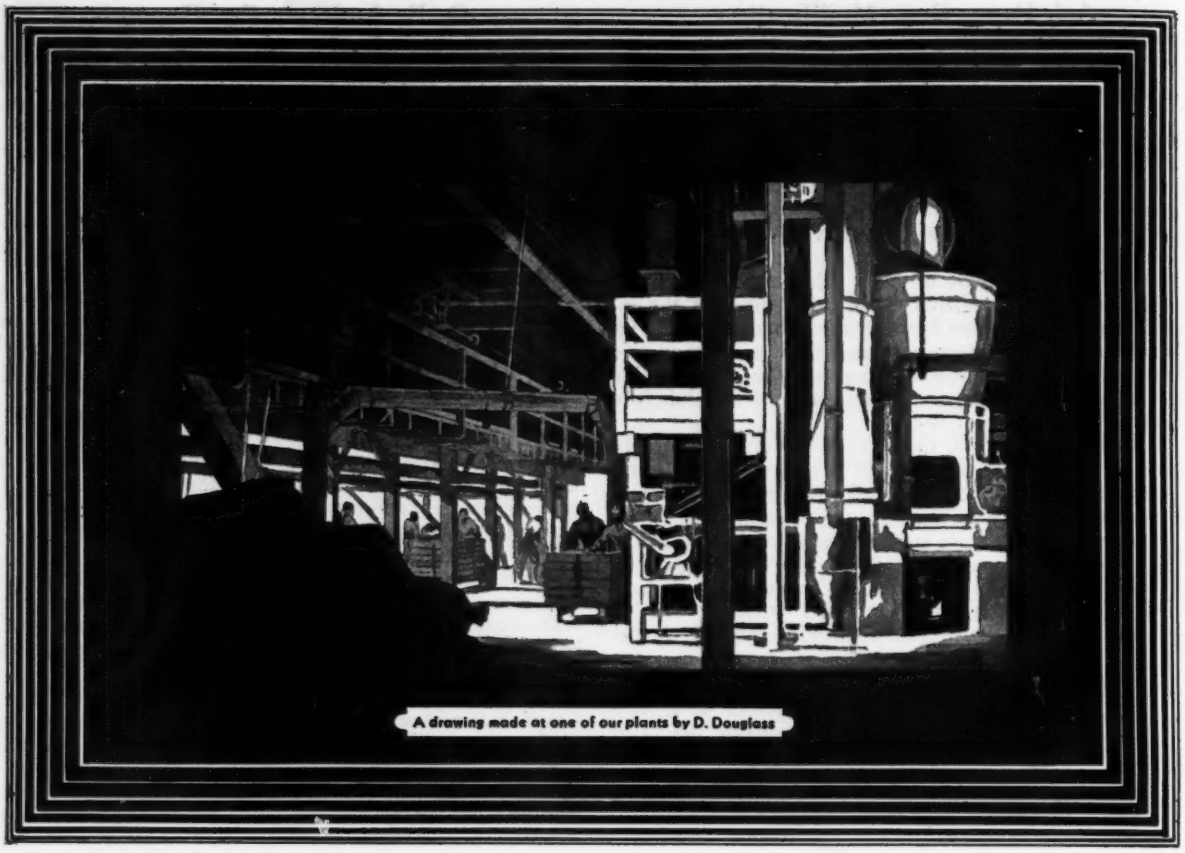
"The sale of containers in the Knoxville district has shown greater increase within the last eighteen months than in any other district in which we operate."

Brown Co. Secures $500,000 Loan

A Boston News Bureau disptach from Berlin, N. H., dated September 8, states that "To continue their woods operations this fall and winter on a more satisfactory basis to the workmen than before, the Brown Company, paper manufacturers, of Berlin, N. H., has borrowed $500,000. The loan was secured through the efforts of Mayor Daniel Feindel.

Having received the official approval of Governor Winant and his Executive Council, the City Council voted Tuesday night to borrow $500,000 on an emergency note payable August 31, 1935, with interest at 5 per cent. The note is secured by the guarantee of the State of New Hampshire.

"A total of 2600 men is expected to be hired for the various camps. The first consignment of woodsmen calls for a total of 935 men."



A drawing made at one of our plants by D. Douglass

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Section of the
Technical Association of the Pulp and Paper Industry
Edited by Ronald G. Macdonald, Secretary

Effect of Experimental Conditions on the Measurement of Air Permeability of Paper*

By F. T. Carson[1]

Abstract

By means of the sensitive instrument recently developed at the Bureau of Standards, a careful study has been made of the relation of the rate of flow of air through paper to the experimental conditions. The results show that with few exceptions the flow of air is proportional to the pressure difference, for small pressure differences; proportional to the time of flow; proportional to the effective area of the specimen; and inversely proportional to the thickness of the material. With the type of measuring instrument used the results do not depend upon the viscosity of the air. The effect of relative humidity is unpredictable. The air permeability of paper was found to increase somewhat with decreasing absolute pressure, an unexpected behavior which may be associated with an elastic expansion of the structure.

Except for the absolute-pressure results, all the data agree remarkably well with Meyer's equation for the flow of a gas through a long capillary tube, and indicate that the air passages in paper behave as if they were a group of capillary tubes having an average length of many times the thickness of the sheet.

A comprehensive definition of air permeability in relation to paper and fiber board is presented, and suggestions are made relative to a standard testing method.

The development of the sensitive air permeability testing instrument illustrated schematically in Fig. 1 has been described in a previous paper. (*1*) The new instrument was designed to obtain accurate values for a wide range of materials. An annular cell DD surrounds the permeability of cell C and serves to by-pass air that leaks in at the edges of the specimen S. Conditioned air at atmospheric pressure has access to the specimen above both cells. A capillary-tube flow meter, consisting of a number of capillaries A, B, etc., of different capacities and a kerosene manometer M, is connected in series with the cell C. One capillary at a time can be opened to the air stream. The capillaries are calibrated against a standardized meter. A partial vacuum in the instrument is produced by an air pump P, resulting in a pressure drop across the instrument not exceeding about 40 grams per square centimeter. Specially designed pressure regulators R_1 and R_2 maintain unvarying pressure heads h and H across the specimen and the flow meter during the test. Air is simultaneously drawn from cells C and DD, the relative flow being controlled by valves W and Z until the two menisci in manometer N remain at the same level. With no lateral pressure gradient across the cell boundary E, edge leakage into C is prevented. The volume of air flowing per second under a pressure difference h through that part of S above cell C is known from h and the calibration data of the capillary flow meter. The precision of the instrument is such that results are reproducible within one half of 1 percent.

A sensitive instrument of this character makes possible the investigation of a number of questions, about which there has been considerable uncertainty arising from differences of opinion of various investigators. One cannot find in the literature satisfactory answers to such questions as the relation of the rate of passage of air through

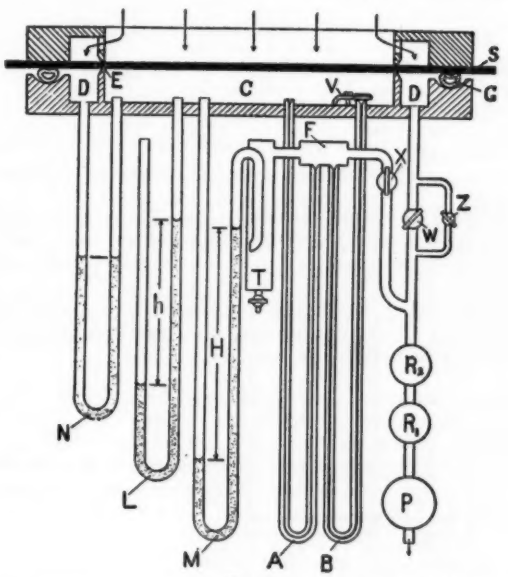

FIG. 1
Schematic drawing of the air permeability instrument used in the investigation.

* Research Paper, RP682, Bur. Stds. J. Res. 12 (May 1934).
[1] Paper Section, Bureau of Standards, Washington, D. C.

paper to the pressure difference across the sheet; or the relation of this quantity to the area and thickness of the material, and to the temperature and relative humidity of the enveloping atmosphere. A knowledge of these relations is necessary to the very definition of air permeability, and without this knowledge it is impossible to set up adequate standards for air permeability measurements. These relations also give information about the structure of fibrous sheets and the probable nature of the air passages.

Relation of the Rate of Flow of Air Through Paper to Various Experimental Conditions

Theoretical Relations

The air passages through paper are very small having cross sections of capillary dimensions. The length of these passages is an unknown quantity; it may be anything from the thickness of the paper to a comparatively lengthy and devious course through the sheet. The cross-sectional contours are irregular in shape and variable in size. Although we do not have equations designed to describe completely the rate of passage of a gas through such a complex structure, we do have, on the one hand, an equation for a straight, tubular capillary the length of which is very great in comparison with the diameter, which is applicable when the flow is streamline; and on the other hand, an equation for the flow of a gas through a nozzle or orifice, which is applicable when the velocity of approach of the gas is small in comparison with the velocity within the orifice. Presumably, within these extremes should be found the essential conditions operative in the passage of air through a sheet of paper.

In the previous publication a simple equation was set down to evaluate the air flow through paper from the data obtained with the new instrument.

$$V = d \cdot \frac{H}{h} \cdot \frac{\phi}{\rho H} \cdot \frac{B-d}{B} \qquad (1)$$

For convenience, this equation was also written in another form, applicable within the limits of ordinary laboratory conditions:

$$\frac{V}{Sd} = \frac{H}{h}(1 - 0.001\,\rho h)\,C \qquad (2)$$

In these equations

V = the volume of air, measured at the inlet (atmospheric) pressure B, which, at a given temperature, flows in unit time through the effective area S of paper across which a pressure difference d is maintained,
ϕ = the same volume, measured at the inlet pressure of the capillary,
H = the pressure head across the calibrated capillary tube,
h = the pressure head across the paper,
ρ = the density of the manometer liquid, and
$C = \frac{\phi}{\rho HS}$ a variable coefficient, corresponding to values of H, obtained from the calibration of the capillary tube and the known value of S.

Equation (1) depends simply upon Boyle's law, and applies, at the temperature of calibration of the capillaries, to any material whatever that can be tested with the instrument.

On the other hand, the equation which, according to Meyer, (2) describes the flow of a gas through the idea capillary tube may be expressed as follows:

$$\phi P = \phi' p = \frac{\pi r^4 (P^2 - p^2)}{16 l \eta} = \frac{k}{\eta} \cdot D \cdot \frac{2P - D}{2} \qquad (3)$$

in which

ϕ = volume of gas, measured at the inlet pressure P, which flows per unit time through the capillary tube,
ϕ' = corresponding volume per unit time measured at the outlet pressure p,
r = radius of the capillary tube,
l = length of the capillary tube,
η = coefficient of viscosity of the gas,
$k = \frac{\pi r^4}{8l}$, a dimensional constant of the capillary tube, and
$D = P - p$, the pressure drop across the capillary tube.

From this equation we may write

$$\frac{\phi}{D} = \frac{k}{\eta} \cdot \frac{2P - D}{2P} \qquad (4)$$

Presuming for the moment that the air passages through a sheet of paper behave as if they were a bundle of capillary tubes, we can, by analogy with equation 4, write:

$$\frac{V}{d} = \frac{K}{\eta} \cdot \frac{2B - d}{2B} = \frac{H}{h} \cdot CS \cdot \frac{B-d}{B}, \text{ by equation 1,} \qquad (5)$$

in which K is a structural constant of the paper, equivalent to Σk for all the capillary passages involved, and the other symbols have the same significance as in equation 1.

If these air passages behave as capillary tubes, we can make the following deductions from the foregoing equations:

1. The constant $\frac{K}{\eta}$ of equation 5 is the limiting value of $\frac{V}{d}$ as d approaches zero. When d is small in comparison with B, the ratio $\frac{V}{d}$ should be nearly constant (V nearly proportional to d). It is logical that d should be small in the measurement of air permeability, since most uses of paper in which air permeability is significant involve very small values for the pressure drop across the sheet. In the new instrument d does not exceed about 10g/cm². Hence if d in the expression $\frac{2B - d}{2B}$ were neglected, the result would not be in error by more than 0.5 percent. The equation then becomes equivalent to that of Poiseuille.

2. In the type of measuring instrument used, the air flow is affected by the viscosity of the air (a function of the temperature) in the same manner in both the capillary flow meter and the paper, if both are capillary in nature. Now, if equations 4 and 5 represent the behavior of the two elements of the instrument, the division of one by the other gives $\frac{D}{d}\left(= \frac{H}{h}\right)$ independent of η. Hence, for given pressure difference the value of $\frac{V}{d}$ (corresponding to the temperature of calibration of the capillary) obtained from equation 1 should be independent of the actual temperature at which the paper is tested by means of this double-flow-meter principle.

3. Since, according to equation 3, the flow of air is inversely proportional to the length of a given capillary, $\frac{V}{d}$ should be inversely proportional to the thickness of the sheet if the structure is homogeneous with respect to the thickness dimension.

4. Within experimental error the value of V, for a given value of d, should be independent of the absolute pressure B over the ordinary range of barometric pressures. The calibrations of the capillaries should likewise be independent of the absolute pressure. This relation becomes evident when we substitute different values for P and B in equations 4 and 5 while keeping the pressure difference constant. For a pressure difference not exceeding 25g/cm², the absolute pressure may differ as much as 10 percent from the standard barometric pressure without altering the rate of air flow by more than about 0.1 per cent for a given pressure difference. Although these

equations indicate that the volume rate of discharge of air (expressed in terms of the pressure at, say, the inlet end) through a capillary at a given pressure difference is the same for all usual values of absolute pressure, it is curious that some investigators have attempted to correct the indicated volume rate of discharge to what it would be under standard conditions, by a mistaken application of Boyle's law.

If, on the other hand, we consider paper as in effect a sheet perforated by a myriad of small orifices we should expect, according to Buckingham, (*3*) the following equation to more nearly describe the behavior of air passing through it:

$$\frac{V}{d} = M\sqrt{T}\,\frac{\sqrt{\left(\frac{B-d}{B}\right)^{\frac{10}{7}} - \left(\frac{B-d}{B}\right)^{\frac{12}{7}}}}{d} \qquad (6)$$

in which M is a constant involving the cross sectional areas of the orifices (but not their lengths), T is the absolute temperature, and the other symbols have the same significance as in equation 5. From equation 6 we can then make the following deductions for a sheet perforated by orifices:

1. The ratio $\frac{V}{d}$ should not be constant with changing pressure difference, but should decrease rapidly as d increases. For small values of d it is nearly inversely proportional to the square root of d by equation 6.

2. We find, by dividing equation 6 by equation 4, that $\frac{D}{d}\left(=\frac{H}{h}\right)$ is nearly proportional to the five fourths power of the absolute temperature, for ordinary room temperatures.[2] Hence the value of $\frac{V}{d}$, determined with the new instrument and equation 1, should differ from that corresponding to the temperature of calibration of the capillary by nearly one half percent for each degree C by which the testing temperature differs from the temperature of calibration.

3. Since M does not depend upon the length of the nozzles or orifices, the value of $\frac{V}{d}$ should be independent of the thickness of the sheet.

4. For a constant pressure difference the rate of passage of air through such a sheet should increase with decreasing absolute pressure. For example, the value of $\frac{V}{d}$ at standard barometric pressure is increased by about 5 percent, according to equation 6, when the barometric pressure is reduced 10 per cent.

The duration of the test and the area of the specimen are also implicitly involved in equations 5 and 6, but a given change in either one of these quantities should affect the results in a like manner, whether the air passages behave as capillaries or as orifices, provided the material is homogeneous with respect to area and is not altered in structure by the testing conditions. Although the effects of varying these quantities in air permeability tests are not useful as criteria of the nature of the air passages, these variables will be treated along with the other experimental conditions because of their importance in the development of standards for air permeability measurements and because investigators do not agree as to their effects on the measurements.

The foregoing criteria for the nature of the structure of paper may be summarized as follows:

If the air passages behave as capillary tubes, $\frac{V}{d}$ should be constant with change in pressure difference, constant with change in temperature, inversely proportional to thickness, constant with change in absolute pressure.

If the air passages behave as orifices or nozzles, $\frac{V}{d}$ should be inversely proportional to the square root of the pressure difference, increase with increasing temperature, constant with change in thickness, increase with decreasing absolute pressure.

In the application of those criteria to the experimental data it should be emphasized that the values of $\frac{V}{d}$ reported do not depend in any way upon air-flow theory nor upon any assumptions about the nature of the air passages through the material tested, since equation 1 is based simply upon the calibration of the instrument.

Effect of Pressure Difference on Rate of Flow of Air

The relation of the pressure difference across the sheet to the rate of flow of air through it is so important to the convenient measurement of air permeability and the expression of the results, and to the translation of the laboratory tests into practical significance, that considerable attention has already been given to the study of this relation. The various reports, however, record a considerable diversity of conclusions. Bergmann and Ludewig, (*4*) working with leather, reported air flow proportional to the pressure difference, but Edwards, (*5*) working with the same material, concluded that air flow is not truly proportional to the pressure difference. Schiefer and Best, (*6*) working with textile fabrics at very low pressure differences, found the two quantities proportional for some fabrics, but not proportional for others. Several investigators have reported results for paper. L'homme et Argy and Bard (*7*) reported the air flow proportional to the pressure difference except for condenser paper. Potts (*8*) concluded that air flow is virtually proportional to the pressure difference, but pointed out that there are exceptions. Silvio (*9*) at first reported the two quantities proportional, except for thin papers or papers of poor formation, and later concluded that air flow is proportional to the 0.925 power of the pressure difference. Stoewer (*10*) found the two quantities proportional, but an anonymous investigator, (*11*) replying to Stoewer, reported not even a semblance of proportionality between pressure difference and the rate of passage of air through paper.

A great many tests have been made with the precision air permeability tester to show, for various kinds of papers and fiber boards, the relation between the pressure difference and the volume of air transmitted per unit time. The value for $\frac{V}{d} \times 100$ are recorded in Tabe I for values of the pressure difference between 0 and 12g/cm$_2$.

[2] The approximate equation $\eta = \eta_0 \left(\frac{T}{273}\right)^{3/4}$ was used to express η in terms of T in equation (4).

TABLE I.—DATA SHOWING THE RELATION OF AIR TRANSMISSION TO THE PRESSURE DIFFERENCE ACROSS THE SHEET

Kind of material	Thickness mm	Ratio of air transmission to pressure difference for pressure differences of— 0 to 4 g/cm² 100V/d	4 to 6 g/cm² 100V/d	6 to 8 g/cm² 100V/d	8 to 10 g/cm² 100V/d	10 to 12 g/cm² 100V/d	Difference first and last columns Per cent
Binders board..	2.30	1.434	1.430	1.430	1.432	1.429	0.4
Lined board ...	1.10	57.3	57.3	57.3	57.5	57.5	.4
Strawboard	.95	198.9	198.4	198.8	199.0	197.9	.5
Tag board.....	.40	118.9	118.6	118.7	118.3	118.3	.5
Parchment deed	.165	2.097	2.098	2.103	2.092	2.084	.6
Machine-finished book	.140	49.05	48.74	48.87	48.85	48.80	.5
Wrapping (No. 2 Kraft.....	.125	269.3	269.2	269.1	267.8	267.4	.7
Bond	.115	11.32	11.35	11.30	11.32	11.28	.4
Coated book...	.090	6.82	6.81	6.81	6.88	6.82	.0
Machine-finished book	.090	171.2	171.2	170.8	171.2	171.4	.1
News print....	.080	517	516	515	514	511	1.2
Supercalendered book	.075	31.17	31.30	31.28	31.07	31.10	.2
Map paper....	.065	10.65	10.62	10.62	10.58	10.56	.8
Manifold tissue.	.065	64.4	53.2	49.3	44.5	40.7	36.8
Stereotype tissue	.040	27.42	26.22	25.79	25.47	24.88	9.3
Glassine	.040	1.668	1.558	1.503	1.466	1.412	15.4

The values in each vertical column were determined at some pressure difference within the pressure range designated at the top of that column.

With the exception of a few of the thinnest papers, the rate of flow of air through the paper is proportional to the pressure difference to within a fraction of 1 percent. These data agree remarkably well with the relation predicted by equation 5 for a capillary-tube structure of paper. In all the tests that have been made the only exceptions found have been thin papers of rather poor formation, in most of which numerous "pinholes," or minute orifices, could be seen extending through the sheet. In these exceptional cases the relation of air flow to pressure difference tends in the direction predicted by the equation for an orifice. The criterion for orifice-like behavior, $\frac{V}{\sqrt{a}} =$ a constant, however, is not satisfied in any case met with, a fact which suggests, for these thin, poorly formed papers, a structure intermediate between capillary-like passages and orifices, or a structure made up of both.

Effect of Time on Rate of Flow of Air

Stoewer (*10*) has presented data to show that the air permeability of paper is a function of the time the paper is exposed in the air stream, and concludes that the pressure difference across the sheet produces a progressive change in the density of the fibrous structure. Although such an effect might result from excessive pressure differences, no evidence of such an effect has been observed within the range of pressure differences used in this investigation. It will be recalled that when the precision of the new instrument was being studied, it was found that successive tests made on a given specimen under carefully controlled conditions agreed within a few tenths of 1 per cent. Further evidence is afforded by the data in Table I. The several values for each material represent varying periods of exposure in the air stream, since all were obtained on the same specimen by successive adjustments of the pressure difference. The time period for each material was about the same as that in Stoewer's experiments.

Although the rate of passage of air through a given structure under given testing conditions is constant with time, the structure may change over a period of time. For example, many instances have been observed in which the air permeability of a specimen was altered after it had gone through a cycle of hygrometric changes, as will later be seen when the effect of humidity is discussed. Such an effect is evidently brought about by changes in the structural relations of the fibers as they absorb moisture and swell, or give up moisture and shrink. An unusual instance has been observed in which the air permeability of a specimen increased tenfold after it had been stored for a year subject to hygrometric changes indoors. Other specimens stored under the same conditions changed very little.

Effect of Area on Rate of Flow of Air

Most investigators have assumed that the quantity of air flowing through paper in a given time is proportional to the area exposed in the permeability cell of the testing instrument. Hanson,[12] however, has presented data indicating that the rate of flow is not proportional to the area exposed. His data show air transmission values in the rate of 1 to 3.2 for areas in the ratio of 1 to 4. He presumed a sufficient distortion of the structure, resulting from the clamping pressure at the boundary of the cell, to account for the discrepancy. The investigation of such a boundary effect, or other contributing factors inherent in the testing method, is complicated by the variability of paper and fiber boards. This difficulty has not arisen in the study of other variables because the tests can be made on identical area of material.

It must be evident, upon reflection, that we do not know what the effective area is when there is a horizontal pressure gradient in the annular area between the clamping rings of the permeability cell. Some air must pass through the structure of the paper in this region, making the effective area greater than the nominal area bounded by the clamping rings. We are not justified, therefore, in concluding with Hanson that the quantity of air transmitted is not proportional to the area exposed to the air stream, because we do not know what this area is. Moreover, we are forced to the conclusion that in none of the twenty-odd designs of air permeability apparatus described in the literature is the test area known except approximately. Even when the sheet is clamped between rubber rings and sealed at the edges there must be some movement of air within the structure lying between the clamping rings.

It will be recalled that in the instrument shown in Fig. 1 the test area is bounded by a narrow ring of metal, and that the pressure drop through the sheet is precisely the same on both sides of this bounding ring. Hence the uncertainty in the test area is not greater than half the contact area of this ring with the material. If the ring is made very narrow and the test area large (since the ratio of periphery to area decreases as the area increases), the uncertainty in effective area can be made very small, but of course never zero. Is the effective area determined by the inside diameter of the bounding ring, by the mean diameter, or by some intermediate value? It is unlikely that it is represented by the inside diameter, since it has been observed that the quantity of air transmitted is decreased slightly by an increase in the clamping pressure. For example, the decrease in air transmitted was found to vary from a negligibly small amount for a thin, hard paper, to about three fourths of 1 percent, for a thick, compressible material, when tests were made with a cell in which the contract area of the right was about 1.5 percent of the test area, and the clamping pressure was varied from that just sufficient to make the balancing manometer function properly, to a pressure sufficient to indent the material.

In order that the effect of area might be studied, another permeability cell was made having an area approximately one tenth that of the original cell. A sheet was first tested in the large cell; then, within the area thus tested, seven tests were made with the small cell,

the seven tests being symmetrically distributed so as to fairly sample the area tested in the large cell. Finally the whole area was again tested in the large cell. The average of the two tests with the large cell (which, for most of the materials tested, agreed to within about 0.3 per cent) was then compared with the average of the seven made with the small cell. Although the materials for these tests were selected with uniformity rather than for variety, they represent considerable differences in characteristics which might be presumed to enter into the case. An antique book paper and a supercalendered book paper were selected for widely different surface characteristics. The strawboard selected is thick and compressible in comparison with the bond paper, and its air permeability per unit thickness is more than a hundred times as great as that of the bond paper. When the results were calculated on the basis of the free area represented by the inner diameter of the clamping rings there was a discrepancy of 3 per cent or more, as shown by Table II. When, however, they were calculated on the basis of the area represented by the mean diameter they were found to be in good agreement. The agreement is, on the whole, so good that we may conclude with confidence that the effective area is sufficiently well represented by the area enclosed within the median circle defined by the average diameter of the bounding ring, and that the quantity of air transmitted is proportional to this area for otherwise identical conditions.

TABLE II.—DATA SHOWING THE RELATION OF THE AREA OF THE SHEET EXPOSED IN THE AIR STREAM TO THE AMOUNT OF AIR TRANSMITTED THROUGH IT IN A GIVEN TIME

	Ratio of air transmitted to area exposed for—					
	Nominal areas [1]—			Effective areas [2]—		
Kind of material	100 cm²	10 cm²	Difference Per cent	100.8 cm²	10.4 cm²	Difference Per cent
Bond paper 1...	11.27	11.68	+3.6	11.18	11.23	+0.5
Bond paper 2...	11.75	12.11	+3.1	11.65	11.64	— .1
Bond paper 3...	10.50	10.86	+3.4	10.41	10.44	+ .3
Bond paper 4...	11.88	12.32	+3.7	11.78	11.84	+ .5
Strawboard 1...	198.8	204.3	+2.8	197.2	196.4	— .4
Strawboard 2...	175.2	180.6	+3.1	173.7	173.6	— .1
Antique book paper	151.2	156.3	+3.4	149.8	150.2	+ .3
Supercalendered book paper...	88.6	91.8	+3.6	87.8	88.3	+ .6

[1] Area of cell aperture.
[2] Area determined by the mean diameter of the bounding ring.

Effect of Temperature on Air Permeability

Measurements were made at the flow of air through papers, fiber boards, and glass capillaries at a relative humidity of 65 per cent and at temperatures 27 and 21.5 deg. C. According to conclusions reached in the section on theoretical relations, this difference in temperature should make no difference in the measurements if we are dealing with capillary phenomena in both the material tested and the capillary flow meter with which we measure the air flow. On the other hand, if the air passages in paper behave as orifices, we should expect the results at the higher temperature to be 2 or 3 per cent higher than those at the lower temperature. The results of the measurements for 10 papers and fiber boards, in the order of decreasing air permeability, are shown in Table III. These data indicate that for ordinary room temperatures, the results by this method of measurement are practically independent of the temperature. This is not true for any of the displacement methods. Similar measurements for two capillary tubes at several values for the pressure difference are also shown in the table, being expressed as the ratio of air flow to pressure difference. These results do not, of course, imply that the actual amount of air going through the sheets or the capillary tubes at the two temperatures was not different, but that in each case the result obtained is the air permeability at the temperature of calibration of the flow meter. The agreement in results at different temperatures in Table III is further evidence that the equation for flow through a capillary applies to paper and fiber boards, and hence that the air passages through them are capillary in nature.

TABLE III.—AIR PERMEABILITY MEASUREMENTS AT DIFFERENT TEMPERATURES

	Air permeability Tested at		
Kind of material	21.5 C cm³/sec/ m²/g/cm²	27 C cm³/sec/ m²/g/cm²	Difference Per cent
Mimeograph paper	282.8	281.3	—0.5
Strawboard	177.0	175.9	— .6
Antique book paper.....	151.1	151.0	— .1
Lined strawboard	128.7	128.0	— .5
Supercalendered book paper.....	86.9	86.9	.0
Sulphite manila tagboard.....	29.81	29.82	.0
Rag index paper.....	11.28	11.29	+ .1
Coated book paper.....	10.18	10.29	+1.1
Sulphite index paper.....	8.69	8.68	— .1
Railroad board	2.56	2.58	+ .8
Capillaries	100V/d	100V/d	
Capillary A ($d = 24$).....	1.237	1.238	+ .1
Capillary A ($d = 16$).....	1.241	1.241	.0
Capillary A ($d = 11$).....	1.247	1.244	— .2
Capillary B ($d = 26$).....	8.98	8.95	— .3
Capillary A ($d = 18$).....	9.13	9.12	— .1
Capillary B ($d = 6$).....	9.38	9.36	— .2

A very important requisite in these tests was the protection of the materials from a change in equilibrium moisture content during the interim between tests at the two temperatures, for otherwise a slight change in structure might ensue. During the interim the materials were kept in an airtight package. Preliminary experiments in which this precaution was not taken were inconclusive.

Effect of Relative Humidity on Air Permeability

The theoretical relations which we have considered do not give us any clue as to what effect the relative humidity of the air might be expected to have on the rate of flow through minute passages, except for the change in the viscosity of the air; and it has just been seen that a change in viscosity (a function of temperature) will not affect the results. There are certain characteristics of minute passages, however, which lead us to suspect the influenece of relative humidity. Very small capillaries are prone to condense water vapor. Obstruction of this nature might be serious at high relative humidity. We should expect this difficulty, if any, with fine glass capillaries used as standards. Tests were made of the behavior of the two capillary tubes in the instrument having the smallest bores, at relative humidities of 65 per cent and below. There was no evidence of fouling by condensation at these humidities.

In the case of paper, we should expect in addition a change in the structure of the sheet to result from the exposure to atmospheres of different relative humidity. The walls of the fibers take up moisture and swell as the relative humidity is increased. This swelling probably increases the size of passages within fibers, but may either increase or decrease the size of passages between fibers, depending upon conditions within the structure. Although we should expect a change in relative humidity to affect the air permeability of paper, we are unable to predict either the magnitude or the direction of this effect. Gallagher (*13*) Hanson, (*12*) and L'homme et Argy and Bard (*7*) found little or no effect of changing relative humidity on the air permeability of paper. Herzberg (*14*) concludes that the swelling of the fibers with increasing relative humidity results in decreasing the air permeability of paper. Stoewer (*10*) presented data to show that papers made with little beating increase considerably in air permeability with increasing relative humidity, but that papers made of well-beaten stock decrease somewhat in air permeability with increasing relative humidity.

The same 10 materials appearing in Table III were tested at a constant temperature and at relative humidities of 45, 55, and 65 per cent, and finally again at 45 per cent. An identical area of each sample was tested throughout to eliminate the effect of the inherent variability of the material, as has been done in all these studies whenever possible. During the interval between successive exposures and tests under different conditions the specimens were sealed in an airtight receptacle with relatively little free space, so that the moisture content of the specimens could not change appreciably. Under these carefully controlled, though limited range of conditions, appreciable effects of the humidity of the air on air permeability were found. But some materials increased while others decreased in air permeability for a given change in humidity. The largest change noted, however, was less than 4 per cent. Two other sets of the same materials were tested over a wider humidity range, although the lower humidities were not under exact control, advantage simply being taken of low humidities in the laboratory on cold, dry winter days. One set was tested first at 10 and then at 65 per cent relative humidity. The other set of samples was tested first at 25, then at 65, then at 10, and finally again at 65 per cent relative humidity. The results for the three sets of tests are summarized in Table IV as percentage changes in air permeability, for the relative humidity range and direction of change in humidity indicated at the top of each column. The materials are again arranged in descending order of air permeability, just as in Table III.

These data indicate that the air permeability of some materials is very little affected by changes in relative humidity, while that of others may be altered at least as much as 15 per cent within the range studied. If the higher range of humidities had been included in the study, considerably greater changes in air permeability might have been found. In general, the behavior of each material is characteristic, although there are some instances of rather erratic change both in direction and magnitude. Certainly, the structure is much less stable with changing relative humidity than with changing temperature when the humidity is constant. It is evident that comparable determinations of the air permeability of paper and boards must be made at a standard relative humidity, since we cannot tell beforehand how a given material will be affected by humidity changes.

TABLE IV.—DATA SHOWING THE EFFECT OF RELATIVE HUMIDITY ON AIR PERMEABILITY

Kind of material	Change in air permeability with change in relative humidity for: First set 45 to 65% relative humidity Per cent	Second set 10 to 65% relative humidity Per cent	Third set 25 to 65% relative humidity Per cent	Third set 65 to 10— relative humidity Per cent	Third set 10 to 65% relative humidity Per cent
Mimeograph paper	— 0.3	— 0.3	+ 0.6	+ 0.6	+ 0.1
Strawboard	— .2	— 2.6	— .2	+ 1.4	— .7
Antique book paper	— .9	— 1.2	— .7	+ 2.4	— 1.6
Lined strawboard	+ .2	+ 1.3	+ .7	+ 1.0	+ .5
Supercalendered book paper	+ 3.5	+11.1	+13.0	— 5.3	+11.4
Sulphite manila tagboard	+ 1.3	+ 3.4	+ 4.2	— .6	+ 3.5
Rag index paper	— 2.8	— 4.7	+ 4.8	+12.5	— 5.0
Coated book paper	— 3.8	.....	— 2.8	+14.9	— 8.4
Sulphite index paper	+ 1.5	+ 7.4	+ 9.6	+ .6	+ 5.6
Railroad board	— 1.6	— 8.6	+ .1	+12.2	— 4.8

Thickness of the Sheet and Air Permeability

For most uses of paper and fiber boards it is not necessary to bring thickness into the expression of the air permeability, since the over-all value is the significant quantity. Sometimes, however, it is necessary to determine the porosity of the fibrous structure, as, for example, in paper-making studies involving the choice and treatment of raw materials and the formation of the sheet, and in studies of the relation of the structure of the material to its physical properties. In such studies the air permeability of a unit thickness of the material is of primary interest and presumes a knowledge of the relation between air permeability and thickness. This relation is also of considerable interest because of its bearing upon the nature of the air passages in paper.

From equations 5 and 6 we may infer that the quantity of air passing through paper should vary inversely as some power of the thickness of the sheet, the power being unity if the air passages behave as long capillary tubes, zero if they behave as orifices or nozzles, and somewhere between zero and unity if they have characteristics intermediate between orifices and long capillary tubes.

Emanueli (*15*) assumed air permeability inversely proportional to thickness and made use of the relation in evaluating his "porosity constant." A few investigators have reported data on this relation, but do not agree in their conclusions. Silvio (*9*) made up sheets in various thicknesses from a given stock or fiber suspension, presuming the sheets to be alike except for the differences in thickness. After measuring the air permeability of these sheets he came to the somewhat startling conclusion that the volume of air transmitted per unit time, area and pressure difference is practically independent of the thickness except for very thin papers. In accordance with the theoretical criteria which we have discussed, this conclusion would indicate that the air passages behave as orifices for all except very thin papers, which is precisely the opposite of what we have found for all other criteria thus far considered. A somewhat similar finding is reported by Seborg, Doughty, and Baird (*16*) who likewise made up sheets in various thicknesses from a given fiber suspension. These investigators controlled also the solid fraction or apparent density of the sheets, so that their conclusions are all the more puzzling. They concluded that air transmission is nearly independent of thickness for a constant solid fraction, except when the solid fraction is less than 0.4, that is, when the volume of solid material (fibers) in the sheet is less than 0.4 of the volume of the sheet. For these more porous materials they concluded that air transmission increases with decreasing thickness. Potts (*8*) used a different method and reached different conclusions. He tested thicker and thicker units built up by placing sheets of paper on top of one another. Using combinations of from 1 to 8 sheets, he came to the conclusion that air transmission is inversely proportional to some power of the thickness. This power was less than one for all the results he reported by this method, and was different for each kind of paper, being smaller for the denser papers. In conclusion, Potts says: "This is experimental proof that the interfiber spaces of paper are not simple capillaries, and that the thickness of the sample should not enter into the expression of permeability until we know more about its meaning." This investigator subsequently reported (*17*) some tests of sheets made in various thicknesses from a given fiber suspension, according to the procedure of Silvio and of Seborg, Doughty, and Baird. These results correspond to a power greater than unity in Pott's equation, and are in strong contrast to the data of the other investigators who used the same method of attack, but who obtained data corresponding to the zero power of the thickness in the equation.

Both of the methods used by the investigators, whose studies have been summarized above, are somewhat at fault for the purpose of determining the effect of thickness upon air permeability. When sheets are made up in different thicknesses from a given stock there is no assurance that the structual pattern will remain constant. Es-

pecially if a hand-sheet machine is used, there is more than a possibility that the orientation of the fibers will change as the thickness of the fiber mat is increased. In fact Seborg, Doughty, and Baird suggest as much in their paper, although they assume an orifice-like mechanism in their perforated-plate analoy. It is conceivable that capillary-like passages of constant length in the different thicknesses of sheets might result from an orientation of the fibers such that they extend from surface to surface in all the sheets. It is difficult to explain otherwise the results obtained by Silvio and by Seborg, Doughty, and Baird. The writer has had an opportunity to test some book papers in different thicknesses, made at the Bureau of Standards on a semicommercial paper machine of the fourdrinier type. These papers were all taken from a single machine run, during which the density was maintained at a nearly constant value while the thickness was varied over nearly a threefold range. The results of these tests, which are shown in Table V, indicate, in contrast with the data reviewed above, that the air permeability is approximately inversely proportional to the thickness of the sheet, except for the very thin sheets. This method of approach may serve very well to explore the possibilities of making paper in different thicknesses so as to have certain characteristics of permeability, but it is inconclusive as a means of finding out how air permeability varies with thickness in a given material.

TABLE V.—DATA SHOWING THE RELATION OF THE AIR PERMEABILITY TO THE THICKNESS OF SHEETS OF PAPER MADE FROM A GIVEN FIBER SUSPENSION, THE DENSITY BEING NEARLY CONSTANT

Thickness L	Air permeability A	A × L	Density
mm.	cm.³/sec./m.²/g./cm.²		g./cm.³
0.085	340.6	29	0.67
.115	322.5	37	.68
.120	350.0	42	.68
.140	300.7	42	.67
.145	293.7	43	.67
.165	254.1	42	.68
.165	259.1	43	.67
.170	292.3	50	.65
.195	230.7	45	.68
.210	210.0	44	.69

The first method used by Potts, in which two or more sheets are tested together, is more suitable, although Potts overlooked some important points in the use of this method of approach. He assumed the air permeability of each sheet in the built-up unit to be the same, and erroneously considered it sufficient to multiply the air permeability figure of this built-up unit by the number of sheets in it, in testing the validity of the inverse proportionality between air permeability and thickness. It is necessary to determine the air permeability of each sheet separately as well as to test them all in combination, and the identical area of each sheet must be exposed in the air stream when the sheets are tested separately and in combination. Although this investigator speaks of precautions to prevent leakage of air between the sheets, his results indicate that he did not prevent this type of leakage. In fact, it is a most difficult thing to do. Even with the instrument used in this investigation, which is designed to prevent a lateral pressure gradient at the cell boundary, it was found necessary, in order to prevent this type of leakage, to seal the edges of the sheets together for a little distance into the annular guard cell. Leakage of air between the sheets at the edges of the permeability cell would account for just the sort of results which Potts obtained. The air transmission decreased less rapidly than the increasing number of sheets would demand, and this tendency became more pronounced as the less permeable types of paper were tested. This type of edge leakage is a far more logical explanation of the type of results obtained than the paradoxical alternative of presuming that the air passages become more and more orifice-like as we deal with papers which are less and less permeable to air.

If two sheets are laid together and tested for air permeability, and if V is the volume of air through a given area in unit time, d the pressure difference across both sheets, d_1 and d_2 the pressure difference across the first and the second sheets, respectively,

$$\frac{V}{d} = \frac{V}{d_1 + d_2} = \frac{\frac{V}{d_1} \cdot \frac{V}{d_2}}{\frac{V}{d_1} + \frac{V}{d_2}} = \frac{ab}{a + b}, \qquad (7)$$

in which we let $a = \frac{V}{d_1}$ and $b = \frac{V}{d_2}$. This relation would probably hold regardless of the nature of the air passages, because the sheets are in series with an air space between, in consequence of which the velocity of approach to each sheet is small in comparison with the velocity within the air passages. However, if the air passages behave as a group of capillary tubes, we can evaluate $\frac{V}{d_1}$ and $\frac{V}{d_2}$, notwithstanding the fact that we do not know the values of d_1 and d_2, because, in that case, each of these ratios is constant for all small values of the pressure difference. Hence we can evaluate these quantities by testing the two sheets separately at any convenient, small pressure difference. Equation 7, therefore, is a criterion for the nature of the air passages when two sheets are tested, first separately and then in combination, and when the precautions discussed above are taken to prevent leakage between the sheets. Results obtained in this way are shown in table 6. A more convincing variation on this procedure, which eliminates the air space between the sheets, is effected by wet-pressing the sheets together so as to make a loosely bound unit.

TABLE VI.—RELATION OF AIR PERMEABILITY TO THICKNESS, SHOWN BY TESTS OF SHEETS MADE SEPARATELY AND IN COMBINATION

	Air permeability of sheets tested			
	Separately		In combination	
			Calculated	
Kind of paper	First sheet a	Second sheet b	ab / a + b	Experimental
	cm.³/sec./ m.²/g./cm.²	cm.³/sec./ m.²/g./cm.²	cm.³/sec./ m.²/g./cm.²	cm.³/sec./ m.²/g./cm.²
Ledger paper	5.175	5.310	2.618	2.619
Bond paper	9.74	10.43	5.040	5.037
Rope manila paper....	107.5	109.2	54.20	54.15
Strawboard	183.0	176.5	89.9	89.4
	Sheets wet-pressed together			
Writing paper	17.74	17.93	8.92	8.90
Cover paper	202.1	175.3	93.9	93.6

After it is dried and conditioned, this double sheet is tested without the edge seal, and then the two halves are peeled apart and tested separately. The last two papers in Table VI were treated in this manner.

These results clearly indicate that, if we increase the thickness of a sheet without altering any other structural characteristic, the new sheet behaves as if we have joined together capillary tubes, that is, as if we have increased the length of the capillary passages in proportion to the increase in thickness. From these experiments we may conclude that air permeability is inversely proportional to the thickness of the sheet, and that the air passages behave, according to the thickness criterion, as if they were long capillary tubes.

Effect of Absolute Pressure on Air Permeability

The effect of the absolute pressure on the air permeability of paper apparently has not figured in the studies of previous investigators reporting in the literature. Ac-

cording to equations 5 and 6, we should expect a change in absolute pressure (within usual limits) to have practically no effect on the air permeability of paper if the air passages behave as capillary tubes, but to have a significant effect if they behave as orifices.

Air flow measurements through capillary tubes and through paper were made with a calibrated capillary flow meter at various values of the absolute pressure between one atmosphere and about nine tenths atmosphere. The apparatus used is shown in Figure II. The reduction in absolute pressure on the inlet side of the test piece was obtained by attaching a small capillary tube R to the inlet of the test piece so that the required pressure drop p would take place through this capillary. A mercury manometer was used to measure this drop. The paper S was sealed with melted beeswax between the two halves of the permeability cell A so no air could leak in at the edges. For most of the tests of this cell was made of two glass funnels butted together. Although the effective area of the specimen was not known, it was constant for a given specimen at the different absolute pressures. When measurements were made on the capillaries of the instrument shown in Fig. 1, these capillaries were connected in place of the pearmeability cell A of Fig. 2. The air flow was measured with the calibrated capillary C. Kerosene manometers were used to measure the pressure drop across this capillary and that across the specimen S. The apparatus was tested for leakage at the maximum value of p which was to be used. The volume of air passing through the test piece was, as usual, expressed in terms of the inlet pressure on it. The air flow was first measured at atmospheric pressure with the capillary R disconnected, and then at pressures 2 to 11 per cent lower than atmospheric, as shown at the head of each column in Table VII.

TABLE VII.—INCREASE IN AIR FLOW WITH DECREASE OF ABSOLUTE PRESSURE

Material tested	Increase in air flow over that at a pressure of one atmosphere at various decreases in absolute pressure									
	2 Per cent	3 Per cent	4 Per cent	5 Per cent	6 Per cent	7 Per cent	8 Per cent	9 Per cent	10 Per cent	11 Per cent
Glass capillary 1.	...	...	0.4	...	0.2	0.6	...	...	0.7	...
Glass capillary 2.	...	...	...	...	...	...	...	...	...	—0.2
Glass capillary 3.	...	...	...	0.4	...	—.1	...	...	—.2	.5
Glass capillary 4.	...	...	—.3	...	...	.0	...	...	—.1	...
Glass capillary 5.	...	0.2	...	...	...	—.2	...	...	.3	...
Printing paper...	...	...	2.0	...	2.1	...	...	...	...	2.9
Lined strawboard	0.6	...	1.2	...	1.4	...	1.8	...	2.9	...
Ledger paper....	.4	1.1	...	...	2.2	...	2.8	...	...	4.0
Bond paper	1.0	...	1.1	1.3	1.8	...	2.5	...	...	2.7
Coated book paper	...	...	...	...	3.6	...	...	5.3	...	...
Double-coated book paper ...	...	...	...	...	...	...	...	...	7.5	...
Alundun disc....	...	...	...	...	...	...	...	...	.5	...

The data in Table VII indicate that the effect of change in absolute pressure on the flow of air through the glass capillaries is negligibly small, being both positive and negative and of about the magnitude of the experimental uncertainty. Number 1 of this group was the only one which appeared to show a consistent, slight increase. It is the one which might be expected to show the least effect, since it has the greatest ratio of length to diameter and, by the criterion of pressure difference, conforms very closely to rate of flow as predicted by the Meyer equation.

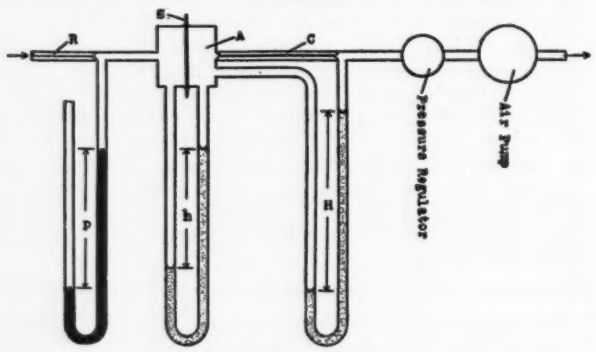

FIG. 2
Apparatus used in experiments at different absolute pressures.

All the papers show an appreciable increase in air permeability with decreasing absolute pressure, and this increase approaches that predicted for an orifice-like structure. At first sight these data appear in sharp contrast with the nearly perfect agreement for a capillary-like structure of paper which we have found by all the other criteria applied. Some of the results in Table VII, however, are too great to be explained on the assumption that the air passages do not behave as capillary tubes. Even if we should assume the air passages to be outright orifices, the greatest increase in air permeability which equation 6 would predict for the absolute pressure range in Table VII is about 5 per cent. We note, however, that the last paper listed shows an increase of 7.5 per cent. Moreover, this paper is well formed and of low permeability. When viewed under the microscope there is nothing to suggest air passages comparable in width to the thickness of the sheet. In fact, by the pressure-difference criterion, the air passages behave as long capillary tubes. Some other explanation must be found for the increase in air permeability of the papers in Table VII. The most likely explanation is a slight expansion of the structure of the sheet when the pressure on the surfaces is reduced, rather rapidly, in the experiments. The expansion in the structure must be elastic, because the air permeability at a given absolute pressure is nearly always a reproducible quantity. An extremely small expansion would be sufficient to account for the results, since the rate of flow of air through a capillary varies as the fourth power of the diameter. The reproducibility of the data for a given decrease in the absolute pressure suggests that the expansion of the structure may be associated with expansion in those voids which do not communicate with the exterior. If the hypothesis of expansion of the structure is correct we should expect a structure that is more rigid than paper to show a smaller effect for a given change in absolute pressure. An alundum disk about 2 mm. thick and more porous than any paper in Table VII was tested in the apparatus of Fig. 2, and the result is given as the last entry in Table VII. The effect of a 10 per cent change in absolute pressure was barely perceptible.

Whether or not the apparent expansion of the structure indicated by these data would occur at higher altitudes is an open question. It may be a variable with differences in barometric pressure, or it may have been brought about by the comparatively rapid exhaustion of the air from the apparatus. From the practical standpoint, however, the influence of absolute pressure cannot be very significant in the testing of paper. In any given locality the fluctuation in barometric pressure is seldom greater than 1 or 2 per cent of the mean annual value. Hence the uncertainty in air permeability measurement resulting from changes in absolute pressure would seldom be as much as 1 per cent at a given place, even if we accept the data of Table VII as indicative of the effect of differences in barometric pressure. Great differences in altitude would, of course, bring the question into more prominence.

Nature of the Air Passages in Paper

With the exception of the absolute pressure data, all the evidence which we have been able to focus on the question has indicated capillary phenomena within the structure of the sheet, and the apparent contradiction in the absolute-pressure data is easily explained on other grounds. The criteria of pressure difference, temperature, and thickness

showed a remarkably close correspondence between experimental data (except for thin, poorly formed paper) and the theoretical equations for the flow of air through long, capillary tubes. This excellent agreement between experimental air-flow data and the theory of flow in capillary tubes is a noteworthy circumstance and throws considerable light on the structure of paper. It is certain that the thickness of the paper does not represent the length of the path through the paper, as has frequently been assumed. In order for the rate of flow of air through a capillary to be nearly proportional to the pressure drop, according to the Meyer equation, the length of the capillary must be very great in comparison with the diameter, of the order of a thousand times as great. Of the four glass capillary tubes in the instrument, only the smallest satisfied this criterion. The ratio of its length to its diameter is about 1,300. The corresponding ratio of the next larger, which failed by some 2 or 3 per cent of satisfying this criterion within the pressure range studied, was about 750. Although we have little information about the behavior of meandering capillaries of irregular cross section, we cannot escape the conclusion that the length of the air passages through paper as compared with the width of these passages must be very great, in order for the air permeability data for paper to satisfy the theoretical equation for an ideal capillary. Knowing that there is great variation in size and shape of these air passages, and appreciating the tortuous course the air must pursue that the path may attain a sufficient length, we find it all the more remarkable that the data should agree so well with the theoretical equation for the simple case. The vegetable fibers of which paper is made are, of course, minute capillary tubes of fairly regular cross section. But during the preparation of the fibers the longer ones are cut into sections and considerable breaking down of the walls occurs. In the fabrication of the sheet the fibers become intricately entangled and pressure is applied to the sheet.

In the finished sheet, therefore, a round, straight, tubular passage would be so rare as to be inconsiderable. Some contend that the fiber canals play a minor role in the mechanism of transfer of a fluid through the sheet, the presumption being that the interstitial labyrinth provides chiefly the means of passage of the fluid. It is more probable, however, that both sets of passages are involved, since the wood fibers, which are so short as to require little cutting, contain many small orifices, or pits, through the walls, and the longer fibers, which do not contain the pits, are cut into sections open at both ends. An examination of cross sections of sheets of paper indicates that the fibers are usually much flattened and so closely compacted that the passages both within the fibers and between the fibers are ribbon-like, and that the widths (narrower dimension) of both kinds of passages are of about the same order of magnitude, which one estimates to range for the most part from about 1 to 10 microns. There are, of course, a considerable number of "caverns" of larger size, which presumably communicate with the labyrinthine pattern. In order for the length of the path of air through the sheet to be 1,000 or more times as great as the width of these passages, the path must be at least a few millimeters long (the order of magnitude of the length of the fibers in paper). But the thickness of some of the papers that behave according to the theoretical behavior of a capillary is considerably less than a tenth of a millimeter. The significant fact, which these data bring out, is that the lateral component of the length of the path of air in passing through a sheet of paper must be rather large in comparison with the normal component, which is the thickness of the paper. The tortuous course pursued may perhaps be something like 100 times the thickness of the sheet.

Suggestions for a Standard Method of Measuring the Air Permeability of Paper

Nomenclature, Definition, and Unit of Expression

Several terms have been used rather loosely in the literature to describe the permeability of paper to air. In addition to air permeability, terms such as porosity, density, and air resistance have frequently been used almost interchangeably. Although air permeability is related to porosity and density, the test does not measure either. Air resistance, as sometimes used in paper testing, is reciprocally related to air permeability. This term is used in a very different sense in aerodynamics. Of the several designations, air permeability is the preferable term, since the primary definition of permeability relates to the ability of a material to permit the passage of a fluid through its porous structure. This is what is actually measured.

The definition of air permeability is difficult to set down in a single statement, since there are so many factors involved. In view of what has been learned in this investigation, perhaps the most logical and comprehensive definition is the following:

The air permeability of a fibrous sheet is measured by the limiting value, as the pressure difference approaches zero, of the ratio of the volume of air which passes in unit time through a unit area of the material to the pressure difference, the volume being measured at the pressure on the inlet surface of the material, and the air in contact with this surface being, throughout the test and for a sufficient time prior to the test for the establishment of hygrometric equilibrium, at a temperature of 21 deg. C., at a relative humidity of 65 per cent, and at a pressure of one standard atmosphere. The limiting value of the ratio mentioned above is chosen because, according to equation 5, it is proportional to a structural constant of the sheet.

For all except a few unimportant, thin papers, the ratio in the above definition is numerically equal to the volume of air that flows through the material per unit time, area, and pressure difference. Hence, for nearly all purposes, it is more convenient to define the air permeability of paper and fiber boards in the following manner:

The air permeability is measured by the volume of standard air which passes in unit time through a unit area of the material when urged by a unit pressure difference (not exceeding about 10 g/cm^2) between the surfaces of the sheet. Standard air, for the purposes of this test, is defined as air at 21 deg. C., at 65 per cent relative humidity, and at a pressure of one standard atmosphere.

It is unfortunate that we cannot omit the absolute pressure requirement from the definition of air permeability, as the theory of capillary flow would permit within the ordinary range of barometric pressures. It is very inconvenient to require a definite barometric pressure for the air in which air permeability tests are made, but, since the investigation has failed to show the air permeability independent of the absolute pressure, we must for the present include a standard barometric pressure in a precise definition. Fortunately, the fluctuations of barometric pressure in a given locality are small enough that they produce effects within the experimental error of the testing instrument, a circumstance which makes it possible to obtain relative air permeability values without cognizance of the absolute pressure. Since the effect of absolute pressure on air permeability seems to be different for different materials, we have no means of converting

air permeability values from one absolute pressure to another. Further investigation of this relation is very desirable in the interest of simplifying air permeability measurements.

Units of expression of air permeability are almost as numerous as are the designs of apparatus for making the measurement. The time required to displace a given volume of air through the test specimen is perhaps the most popular mode of expression. Few investigators have attempted to express the results so as to be intelligible in the absence of specific information about the apparatus and experimental conditions. Metric units, English units, and absolute units have been used. To conform to the definition suggested above, the units of expression must involve the volume of standard air which flows through a unit area of the material in unit time for a unit pressure difference. The unit which has been found convenient in this investigation expresses the volume in cubic centimeters, the time in seconds, the area of material in square meters, and the pressure difference in grams per square centimeter and is abbreviated to: $cm^3/sec/m^2/g/cm^2$. Although comprehensive, such an expression is rather awkward. Possibly we can look forward to the adoption at some time of a comprehensive definition of the unit of air permeability to which a simple name can be given in the manner customary in the field of electrical units.[3]

Apparatus and Testing Conditions

This investigation has provided an accurate method of measuring the air permeability of paper and fiber boards, and, therefore, a means of appraising other methods of making the measurement. It has not, however, included such an appraisal, without which we cannot say to what extent other apparatus might be suitable. As a result of the investigation we can state the essential characteristics of a reliable apparatus. Such an apparatus should be so designed that conditioned air is caused to flow through the specimen, and the apparatus should measure all the air that comes through the area designated as the test area and no air from any other source. This requirement means an effective prevention of leakage across the clamping surfaces and through the edges of the specimen. An easy means should be provided for testing the apparatus as a whole against leakage. The pressure difference obtainable across the sheet should not exceed about 10 g/cm^2, and should be constant while the test is being made.

For precise work the experimental uncertainty should be as small as possible and the testing conditions should conform to the requirements of the definition in the previous section. For most ordinary testing, however, it is probable that an uncertainty of 2 or 3 per cent would be permissible in the calibration of the apparatus, in the constancy of the pressure difference, in the value of the pressure difference, in the readings of the instrument, and in the effective area of the specimen. The absolute-pressure effect will, in general, be within this range of experimental uncertainty for stations under 2,000 feet above sea level. The air passing through the paper should be at 21 deg. C. and 65 per cent relative humidity, the standard paper testing conditions. The material tested should be in hygrometric equilibrium with this air.

[3] The name "perm" has been suggested for the fundamental cgs unit for the permeability to gases of all porous sheet materials. The "perm" would be defined as the volume of gas in cubic centimeters which flows per second through 1 square centimeter of the material under a pressure difference of 1 dyne per square centimeter ($cm.^3/sec./cm.^2/dyne/cm.^2$). Practical units of convenient magnitude would then be derived from this fundamental unit. This would form a logical basis for the correlation of the numerous units of permeability to gases used by different investigators and in different fields. The author wishes to acknowledge his indebtedness to H. D. Hubbard of the staff of the Bureau of Standards for these suggestions.

Literature Cited

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(5) J. Int. Soc. Leather Trade Chem. 14:392 (1930).
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(7) La Papeterie 53:1438 (1931); Pulp Paper Can. 33:177 (1932).
(8) Proc. Tech. Sec. Papermakers' Assn. Gr. Brit. and Ir., 12:91 (1931); World Paper Trade Rev., 96:1257 (1931).
(9) Paper Makers Mo. J., 68:433 (1930); 69:194 (1931).
(10) Wochbl. Papierfabr., 64:57 (1933).
(11) Wochbl. Papierfabr., 64:174 (1933).
(12) Paper, 33, No. 20:11 (Mar. 6, 1924).
(13) Paper, 33, No. 22:5 (March, 1924).
(14) Papierprüfung, 6th Ed.,:216 (1927).
(15) Paper Trade J., 85 (T.S. 98) (1927).
(16) Paper Trade J., 95 (T.S. 144) (1932).
(17) Proc. Tech. Sec., Papermakers' Assn. Gr. Brit. and Ir., 12:118 (1931).

Victor Lubricator Improved

Recently announced, the new 1000 Series Victor Automatic-Force-Feed Lubricators incorporate a number of important improvements. Cadmium plated steel replaces brass for greater tensile strength and to reduce breakage loss. A new sight feed provides double visibility—reservoir supply as well as rate of feed. A new, larger filler tube permits easier, faster filling. A new top stamping, drawn and threaded, eliminates the hex nut formerly required. A new cap, redesigned to include a patented washer retained, eliminates the cap retaining wire previously used, and a new valve control inside the filler tube, discourages tampering with the initial adjustment.

The new Victors, as were their forerunners, are of air-tight construction, are completely self-contained, and feed oil under pressure generated within the lubricator (not by gravity) as dictated by the bearings actual needs. Oil temperature variances, by causing expansion or contraction of the fractional cubic inch of air imprisoned near the base of the filler tube, regulate the rate of oil flow.

Among the Victor advantages stated by the manufacturer are: increased lubrication efficiency through constantly controlled, automatic and fool-proof oil supply; oil savings of from 60 to 90 per cent; perfect cleanliness—no dripping or oil throwing; reduced machinery depreciation and power consumption—less shut-downs in due to faulty lubrication.

Drastic price reduction—approximately 50 per cent—throughout the entire line, and applying to the High Heat Lubricators, Crank Rod or Eccentric Lubricators and Loose Dulley Lubricators as well as to the standard models have been made.

Full details of the Improved Lubricator may be had from the Victor Lubricator Company, a subsidiary of the Victor Adding Machine Company, at 360 N. Michigan Boulevard, Chicago, Ill.

New Magnus Chemical Folder Issued

The Magnus Chemical Company, of 22 South Avenue, Garwood, N. J., has just issued a new folder, which describes "Magnusol," a new process for completely removing oil, grease, dirt, smut, pigments and abrasives from metal. This new process possesses great efficiency in cleaning heavy equipment, motor blocks and chassis. Copies of the folder may be obtained upon application.

Approved Pulp Testing Chemist

The Joint Committee on Approved Pulp Testing Chemists for the Paper Industry, 122 East 42 street, New York, announces that Robert F. Huntley, Oswega Falls Corp., Fulton, N. Y., has been accepted by the Committee as an approved mill pulp testing chemist, and is listed as such, effective September 8, 1934.

Pulp and Paper Industry Literature Review

Abstracts of Articles and Patents Compiled by the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Power House

Economic Aspect of Stoker Application. R. A. Foresman. Paper Trade J. 98, No. 9: 33-36 (March 1, 1934).—An analysis of the influence of stoker design on capital expenditures for the generation of power, with special emphasis on the multiple-retort stoker.—A. P.-C.

Steam Energy in Paper Mills. Fred S. Jones. Paper Mill 56, No. 43:13-14 (Oct. 28, 1933).—Various improvements that have been successfully applied in paper mill steam power plants are pointed out.—A. P.-C.

Progress in the Production and Transmission of Heat and Power. S. A. Staege and C. A. Cajanus. Paper Trade J. 98, No. 14: 41-43 (April 5, 1934).—A brief report of outstanding developments during 1933.—A. P.-C.

Scientific Boiler Feed Water Conditioning. Kenneth Shibley. Pacific Pulp Paper Ind. 7, No. 10: 19-22 (Oct., 1933).—A brief discussion of the manner of carrying it out and of its advantages.—A. P.-C.

Industrial Water Problems and Their Correction. Sheppard T. Powell. Paper Trade J. 98, No. 15: 24-27 (April 12, 1934).—The controlling factors in adequate water conditioning are indicated, and attention is directed to certain developments in the art influencing favorably the performance of such equipment.—A. P.-C.

Miscellaneous

Paper Mill Fire Hazards. M. E. Bulske. Paper Ind. 16: 34-37 (April, 1934).—A discussion of the principal fire hazards and their prevention.—A. P.-C.

Research and Vision in Industry. Horace B. Speakman. Pulp Paper Can. 35: 117-121 (Conv. Issue, 1934).—An address.—A. P.-C.

Trade Names and Their Significance. Frederick C. Clark. Paper Trade J. 98, No. 8: 71-108 (Feb. 22, 1934).—A paper classification chart based on the decimal system is presented by means of which the relationship between all kinds of paper may be established.—A. P.-C.

Imperishable Documents. James Strachan. Paper Maker & Brit. Paper Trade J. 87: TS33-34 (Jan., 1934).—From a brief discussion of the Digby process (platinum printing on sheet gold) from both a commonsense and a scientific point of view, it is considered extremely unlikely that this method of preserving valuable records will ever become a practical proposition.—A. P.-C.

The Future of the Chemist in Industry. S. Reginald Price. Paper Maker & Brit. Paper Trade J. 87: 124, 126, 128 (Feb. 1, 1934).—An address.—A. P.-C.

Thermal Insulation With Aluminum Foil. J. F. O. Stratton. Paper Trade J. 98, No. 9: 37-39 (March 1, 1934).—The advantages of Alfol, an aluminum-foil insulator, are discussed.—A. P.-C.

Report of the Committee on Pulpwood. R. W. Sterns *et al.* Pulp Paper Can. 35: 82-83 (Conv. Issue, 1934).—Two commercial tests carried out with the preservative "lignasan" (the toxic constituent of which is ethyl mercuric chloride) by spraying on wood sent to the storage pile gave contradictory results—in the first case the wood was in practically the same condition after 9 months' storage; in the second case it was badly discolored and showed considerable surface development of fungus after 4 months' storage. Preliminary experiments have indicated that as the specific gravity of wood increases there is an almost proportionate increase in the yield of pulp per unit of wood volume.—A. P.-C.

Preparation of Coal for the Market. R. G. Evans. Paper Maker & Brit. Paper Trade J. 87: TS 44-48, 54-59 (Jan., Feb., 1934); World's Paper Trade Rev. 101: 22-26, 66, 68, 107-110, 148, 150, 318-324 (Jan. 5, 12, 26, 1934).—A description of modern methods.—A. P.-C.

Progress of the Division of Industrial and Cellulose Chemistry, McGill University. Harold Hibbert. Pulp Paper Can. 35: 163-166 (Feb., 1934).—A brief review of the work on cellulose and lignin chemistry carried out during 1933.—A. P.-C.

Research Progress in the Division of Physical Chemistry, McGill University. O. Maass. Pulp Paper Can. 35: 167-171 (Feb., 1934).—A brief review of the work of interest to the pulp and paper industry carried out during 1933.—A. P.-C.

Research Progress in the Pulp and Paper Division of the Forest Products Laboratories of Canada. J. H. Ross. Pulp Paper Can. 35: 172-174 (Feb., 1934).—A review of the work done during 1933.—A. P.-C.

The Future of Cellulose and Pulping Processes. James Strachan. Paper Maker & Brit. Paper Trade J. 86: TS177-178 (Oct. 2, 1933).—A very brief discussion.—A. P.-C.

Modern Developments in Applied Cellulose Chemistry. Gustavus J. Esselen. Ind. Eng. Chem. 26: 26-30 (Jan., 1934).—A brief review of recent developments and present-day trends.—A. P.-C.

Marginal Problems in Mill and Woodlands Departments. F. L. Mitchell. Pulp Paper Can. 35: 89-94 (Conv. Issue, 1934).—Howard Kennedy. Ibid 95-96.—Addresses discussing problems of direct interest to both the woodlands department and the mill-operating departments of pulp and paper companies, bringing out the advantages to be derived by both from a better appreciation and understanding of mutual problems.—A. P.-C.

Corrugated Board Industry in Sweden. W. M. Kollen. Svensk Pappersförädlingstid. 1, no. 1: 2-4; no. 2: 7-10; no. 3: 11-13; no. 4: 15-17 (Jan. 15, 31; Feb. 15, 28, 1934).—The corrugated board industry in Sweden is described, including different types of shipping containers and methods for testing their strength. A great number of illustrations are taken from the pamphlet, "Corrugated and solid fiberboard boxes," published by the Laboratoire général pour emballages in Paris, which is financed by the Scandinavian kraft pulp industry.—C. J. W.

A Case of Fungus Formation on Sulphite Pulp. E. Opfermann. Papier-Fabr. 31, No. 49: 642-43 (Dec. 3, 1933).—A description of a case of fungus growth on sulphite pulp which occurred in a freight car during transit

and was finally traced to the fact that a phosphate fertilizer had been shipped in the car previously.—J. F. O.

Atmospheric Oxygen, a Factor in the Formation of Wood. Carl G. Schwalbe and K. Erik Neumann. Cellulosechemie, 14, No. 10: 133-34 (Oct. 15, 1933).—During the vegetation period atmospheric oxygen penetrates through the bark of the pine and beech to the cambial layer but with spruce it seems that the tannin in the bark hinders the penetration of the oxygen to the cambial layer. If the bark of the pine and beech is bandaged with an air-tight covering, the formation of lignin is reduced about 10 per cent. The greater part of the pentoses necessary for the formation of pectin and lignin must be prepared in the spring sap.—J. F. O.

Comparison of German and Swedish Methods for the Determination of the Degree of Cooking of Sulphite and Sulphate Pulps. D. Johansson. Svensk Pappers-Tidn. 37, No. 4: 100-102 (Feb. 28, 1934); Papierfabr. 32, No. 15: 172-175 (April 15, 1934).—German and Swedish pulps were used in a study involving the Johnsen-Waldhof permanganate and the Roe chlorine number methods for determining the degree of cooking. The Roe chlorine number was found suitable for all grades of pulps, including bleached to the strongest unbleached sulphite pulps. The author suggests, however, that results be reported as Roe units, ten Roe units being equivalent to the Roe chlorine No. 1.—C.J.W.

The Determination of Lignin According to the Method of the Forest Products Laboratory in Comparison with the Method of Zellstofffabrik Waldhof. August Noll and Fritz Bolz. Papier-Fabr. 31, No. 45: 594-96 (Nov. 5, 1933). Lignin determinations were carried out according to the two above methods on unbleached sulphate pine pulp, bleached and unbleached spruce sulphite and aspen sulphite pulps and the results compared. Methods and results are given and tabulated.—J. F. O.

Research of British Chemists in the Field of Cellulose and Paper Making. Louis E. Wise. Paper Ind. 15: 192-194 (July, 1933).—A very brief summary of researches having a direct or indirect bearing on the pulp and paper industry, carried out during the past two and a half years by investigators in Great Britain.—A. P.-C.

United States Patents on Paper Making. Second Quarter 1933. Clarence J. West. Paper Trade J. 97, No. 5: 35-37 (Aug. 3, 1933).—A list in numerical sequence of patents relating to pulp and paper making issued at Washington during April, May and June 1933. —A. P.-C.

Application of Superficial Phenomena in the Production of Paper and Cellulose. I. Resinous matter and its removal by the flotation process. I. I. Kovalevskii. Bumazhnaya Prom. 12, no. 2-3:15-26 (1933).—By flotation of cellulose with calcium hydroxide and kerosene at 20-35 deg. C., 47.2 per cent of the total ether-extractable fatty and resinous matter was removed, its content being reduced in the cellulose from 1 to 0.3 per cent.—C. J. W.

New and Future Uses of Paper. Edward T. A. Coughlin. Paper Mill 56, No. 24: 4, 6, 8 (June 17, 1933).—A general discussion.—A. P.-C.

Paper Making Developments. J. Melrose Arnot. World's Paper Trade Rev. 100: 496-504 (Aug. 18, 1933). —An outline of some notable features of the last 50 years. —A. P.-C.

Technical Control. G. E. Landt. Paper Mill 56, No. 17: 6, 12-13 (April 29, 1933).—An address explaining the aim, function and limitations of technical control.—A. P.-C.

Modern Paper Making Practice. J. Melrose Arnot. World's Paper Trade Rev. Tech. Conv. No.: 2-10 (March, 1933).—A brief review of some recent developments in sulphite digestion, chlorine bleaching, the paper machine and process control.—A. P.-C.

Instrumentation. B. W. Sawyer. Pacific Pulp Paper Ind. 7, No. 7: 10-12 (July, 1933).—The very wide application of instruments for process control is exemplified, with particular attention to the pulp and paper industry.—A. P.-C.

Coordination of Practical and Technical Activities. E. C. Gildenzopf. Paper Mill 56, No. 17: 8, 13 (April 29, 1933).—An address emphasizing the importance of cooperation between the operator and the technician.—A. P.-C.

Technical Control In a Tissue Mill. H. H. Harrison. Paper Ind. 15: 307-310 (Sept., 1933).—A general discussion.—A. P.-C.

The Waste Water in Groundwood Mills. H. O. Stretmo. Papir-J. 21, no. 4:34-37 (Feb. 28, 1933).—The author suggests preventing fiber losses in groundwood mills by using a more or less closed waste water system and introducing as little fresh water as possible for spray-(1-2 per cent instead of 5 per cent).—C. J. W.

pit which must be balanced by lower pulp concentration

Operating Division Development Report. Frederick C. Clark. TAPPI Papers 16: 398 (June, 1933); Paper of recent developments in various departments of pulp and

Spreader Bar for Calenders. James R. Simpson. U. S. pat. 1,896,205 (Feb. 7, 1933).—The invention provides a spreader bar, preferably in the form of a light weight metal pipe, bent through a small angle equi-distant between its ends, and supported at its ends for yielding vertical movement. Means are provided for permitting axial adjustment of the position of the bar in its support to accommodate sheets of different weight.—A. P.-C.

Water Resistance of Paper Board. Philip W. Codwise. Paper Trade J. 98, No 10:43-45 (March 8, 1934). —A description of an adaptation of the dry-indicator test which is considered suitable as a standard method for determining water penetration through paper board.—A.P.-C.

Results on Newsprint Obtained By Use of the Bekk Smoothness and Porosity Tester. L. C. Anderson. Pulp Paper Can. 35: 85-86 (Conv. Issue, 1934).—A study of the instrument as used for the testing of standard newsprint (33-lb. basis weight) showed that the time factor for converting results by the "rapid" method to those by the "precise" method is about 10.9; that the time with the "rapid" method must read to 0.1 sec. to obtain the same accuracy as the "precise" method; and that there is a rather large probable error in testing newsprint due to lack of uniformity so that at least 10 (and preferably 20) tests should be made to obtain a good average value.—A.P.-C.

Mechanical Tests on Pulp and Paper. R. Korn. Z. Ver. deut. Ing. 77:1301-1307 (1933).—Korn discusses briefly the principal physical tests which are applied to pulp and paper, with particular reference to the mechanism of the various testing devices. The following tests on paper are outlined: pop test, tear, impact test, compression and hardness, stretch, air and steam penetration, surface smoothness, size absorption, fastness to rubbing, test for surface grit, and embossing and lithographic properties. In addition Korn discusses the strength test as applied to pulps, by preparation of hand sheets and determination of bursting strength on the latter. Photographs and schematic diagrams of the instruments are included—C.J.W.

IMPORTS OF PAPER AND PAPER STOCK

NEW YORK, BOSTON, PHILADELPHIA AND OTHER PORTS

NEW YORK IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

CIGARETTE PAPER

Champagne Paper Corp., Sarcoxie, St. Nazaire, 944 cs.; H. H. Strauss, Sarcoxie, Bordeaux, 205 cs.; American Tobacco Co., by same, 137 cs.; do, Ile de France, Havre, 100 cs.; Standard Products Corp., by same, 142 cs.; Champagne Paper Corp., by same, 590 cs.; De Manduit Paper Corp., Manhattan, Havre, 132 cs.

WALL PAPER

Bendix Paper Co., St. Louis, Hamburg, 7 cs.; R. F. Downing & Co., Venice, Maru Kobe, 10 bls.; ———, Manhattan, Havre, 7cs.

PAPER HANGINGS

W. H. S. Lloyd & Co., American Trader, London, 2 cs.

NEWSPRINT

Perkins Goodwin & Co., Pr. Harding, Hamburg, 50 rolls; ———, by same, 141 rolls; Perkins Goodwin & Co., St. Louis, Hamburg, 317 rolls; H. G. Craig Co., Inc., Donnacona 1, Montreal, 581 rolls; Jay Madden Corp., Manhattan, Hamburg, 66 rolls, 18 bls.; Walker Goulard Plehn Co., by same, 101 bls.; ———, by same, 264 rolls; Perkins Goodwin & Co., Hamburg, Hamburg, 504 rolls; ———, Tonsbergfjord, Oslo, 209 rolls.

PRINTING PAPER

International F'd'g Co., Pennland Antwerp, 7 rolls, 11 cs.; Steiner Paper Corp., by same, 3 cs.; Windor Newton, Inc., American Trader, London, 2 cs.; L. A. Consmiller, St. Louis, Hamburg, 26 cs.; Senefelder, Inc., Hamburg, Hamburg, 23 cs.

PACKING PAPER

Scharf Bros., Inc., Statendam, Roterdam, 5 cs.; J. P. Heffernan Paper Co., St. Louis, Hamburg, 16 bls.

WRAPPING PAPER

Phoenix Shipping Co., Hamburg, Hamburg, 2 cs.

FILTER COMPOUND

Gerhard & Hey, Statendam, Rotterdam, 80 cs.

LITMUS PAPER

Pfalz & Bauer, Manhattan, Havre, 1 cs.

FILTER PAPER

H. Reeve Angel & Co., Inc., American Trader, London, 10 cs.; do, Majestic Southampton, 144 bls., 33 cs.; A. Giese & Son, Aquitania, Southampton, 86 bls.

DRAWING PAPER

H. Reeve Angel & Co., Inc., American Trader, London, 4 cs.

SURFACE COATED PAPER

Chas. Happel, Pr. Harding, Hamburg, 43 cs.; Gevaert Co., of America, Pennland, Antwerp, 61 cs.; J. H. Bachman, St. Louis, Hamburg, 19 cs.

METAL COATED PAPER

K. Pauli Co., St. Louis, Hamburg, 13 cs.

PHOTO PAPER

Medo Photo-Supply Co., Aquitania, Southampton, 1 cs.

TISSUE PAPER

W. J. Byrnes, Aquitania, Southampton, 1 cs.

WRITING PAPER

Thomas & Pierson, Majestic, Southampton, 3 cs.; American Express Co., Manhattan, Havre, 1 cs.

PASTE BOARD

———, Manhattan, Havre, 40 cs.

MISCELLANEOUS PAPER

Walker Goulard Plehn Co., Pr. Harding, Hamburg, 267 bls., 447 rolls; Kouffel & Esser Co., by same, 64 cs., 22 rolls; F. C. Strype, Statendam Rotterdam, 16 rolls, 6 cs.; Rohner Gehrig & Co., Ile de France, Havre, 2 cs.; E. Fougera, by same, 20 cs.; Keller Dorian Paper Co., by same, 1 cs.

RAGS, BAGGINGS, ETC.

———, Black Tern, Rotterdam, 50 bls. pickers; New England Waste Co., Venice Maru, Shanghai, 100 bls. cotton waste; T. D. Downing & Co., Caledonia Glasgow, 105 bls. bagging; E. J. Keller Co., Inc., Exochorda, ———, 94 bls. paper stock; do, McKeesport, ———, 77 bls. bagging.

OLD ROPE

W. Steck & Co., Cristobal, Cristobal, 66 bls.

CASEIN

D. C. Andrews & Co., Hamburg, Hamburg, 50 bags.

WOOD PULP

E. J. Keller Co., Inc., Manhattan, ———, 330 bls. wood pulp 51 tons; Castle & Overton, Inc., Hamburg, Hamburg, 1365 bls wood pulp 270 tons; Bank of N. Y. Trust Co., by same, 280 bls wood pulp 56 tons; Price & Pierce, Ltd., Greisheim, Wallvik, 625 bls. mechanical pulp 125 tons, do, by same, 1950 bls. sulphite 325 tons; ———, Greisheim, Hernosand, 600 bls. sulphite 100 tons; Price &

Pierce, Ltd., by same, 450 bls. sulphite 75 tons; Pagel Horton & Co., Inc., Greisheim Gefle, 750 bls. sulphite; Stora Kopparberg Corp., by same, 905 bls. wood pulp; J. H. Faunce, Caledonia, Glasgow, 134 rolls pulp; J. Andersen & Co., Tonsbergfjord, Oslo, 250 bls. sulphite; Guaranty Trust Co., Tonsbergfjord, Drammen, 1300 bls. sulphite; Irving Trust Co., Tonsbergfjord, Oslo, 1500 bls. chemical pulp; Chemical Bank Trust Co., by same, 3300 bls. sulphite; The Borregaard Co., Inc., Tonsbergfjord, Sarpsborg, 672 bls. sulphate.

BOSTON IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

———, C. H. Cramp, Woodfibre, B. C., 4510 bls. pulp; E. J. Keller Co., Inc., Haimon, ———, 360 bls. paper stock.

PHILADELPHIA IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

The Lang Co., Sarcoxie, St. Nazaire, 336 bls. rags; E. J. Keller Co., Inc., Sarcoxie, ———, 174 bls. rags; The Lang Co., Sarcoxie, Bordeaux, 112 bls. rags; Castle & Overton, Inc., by same, 511 bls. rags; E. J. Keller Co., Inc., Black Tern, ———, 380 bls. rags; National Wiping Cloth Co., Royoyo Maru, Keelung, 25 bls. rags.

BALTIMORE IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

Congoleum Nairn Co., Sarcoxie, Bordeaux, 301 bls. rags, National City Bank, Ida Trieste, 124 bls. rags; ———, Venice Maru, Kobe, 200 bls. rags.

NORFOLK IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

E. J. Keller Co., Inc., Black Tern, ———, 73 bls. rags.

HOUSTON IMPORTS

WEEK ENDING SEPTEMBER 8, 1934

———, Ida Trieste, 94 bls. bagging; Mitsui & Co., Ltd., Venice Maru, Kobe, 100 bls. rags; Darmstadt Scott & Courtney, by same, 420 bls. bagging; Burke Bagging Corp., by same, 420 bls. bagging.

Waste Paper Code Discussed

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., September 10, 1934—A discussion of the Supplemental Waste Paper Code and its effect on the market took place at a meeting of the Boston Chapter of the American Institute of Paper Mills Supplies, held at the Hotel Touraine Thursday evening. The principal mills in the New England district have observed the Code faithfully, according to general agreement, although one large Connecticut buyer of mixed paper has withdrawn from the market since the new prices became effective. Interpretations of bundled news, small mixed paper bales, discount and f.o.b. prices were among the subjects of discussion and the previous rulings were reaffirmed. Advices were received from New York that the Code Authority had changed its interpretation of the clause "f.o.b. packers' doors" to apply to shipments made f.o.b. cars. As local dealers had not heard of this change of interpretation they declined to accept it.

Obituary

Charles K. Wadham

[FROM OUR REGULAR CORRESPONDENT]

DALTON, Mass., September 10, 1934.—Charles K. Wadham, for 35 years associated with Crane & Co., paper manufacturers, as a commercial representative, and whose hobby was the collecting of autographs, died in his Main street home last week. He was 83 years old.

Among prized autographs in his unusually large collection are those of Ralph Waldo Emerson, Whittier, Longfellow, James Russell Lowell, Oliver Wendell Holmes, Horace Greeley, Generals U. S. Grant, Sheridan and Sherman, Admiral Farragut, James Whitcomb Riley, Josh Billings and others.

Mr. Waldham was born in Boston, March 25, 1851, son of George and Mary (Tuite) Wadham, and entered the paper business as a youth. He sold Crane paper as early as 1890.

He leaves besides his wife, the former Marion O. Irvin of Chicago, one son, John Pray Wadham of Harrisburg, Pa., and a daughter, Miss Helen Wadham of Newton.

Frederick Wittsche

[FROM OUR REGULAR CORRESPONDENT]

PITTSBURGH, Pa., September 10, 1934.—Frederick Wittsche, aged 72, president of the Huff Barnes & Opie Company, died in his home at 1409 Alton street, Beechview, last week.

Born in Germany, Mr. Wittsche came to Pittsburgh 52 years ago. He had been connected with the Huff Barnes & Opie Paper Company 28 years. He was a member of the Holy Trinity Lutheran Church, Beechview; Dallas Lodge, No. 508 F. and A. M.; Zerubbabel Chapter, No. 162; R. A. M.; Mt. Moriah Council No. 2; Pittsburgh Commandery Knights Templar; Pennsylvania Consistory, Valley of Pittsburgh, and Syria Temple. He leaves his wife, Jennie Wittsche; two sons, Fred M., and Harry Critchlow Wittsche, and five grandchildren.

George M. Krockenberger

[FROM OUR REGULAR CORRESPONDENT]

DEFERIET, N. Y., September 10, 1934.—Word reached here this week of the death at Rochester of George M. Krockenberger, former superintendent of the St. Regis Paper Company, who was well known in Northern New York. He was born in Germany sixty years ago but came to this country when a youth. From 1920-22 he served as superintendent of the local branch of the St. Regis Paper Company and from 1923-25 he acted in a similar capacity of the mills of the company at Norfolk, Norwood and Raymondville. His wife, a son and a daughter are the principal survivors.

Clarence Palmer

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., September 10, 1934.—Clarence Palmer, 53 years old, manager of the Elwood, Ind., plant of the Associated Box Corporation, died recently in a hospital in that city following a long illness. He had been in failing health for about a year and was removed to the hospital several weeks prior to his death. He had been a resident of Elwood 35 years and had been connected with the box company eighteen years. The widow, two daughters and his mother survive.

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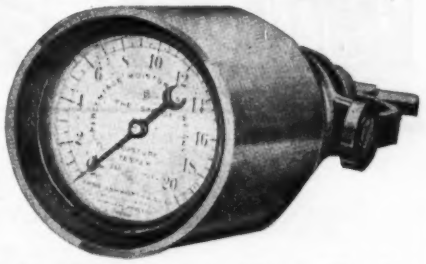

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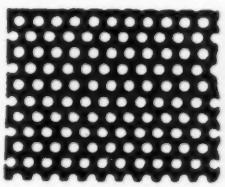

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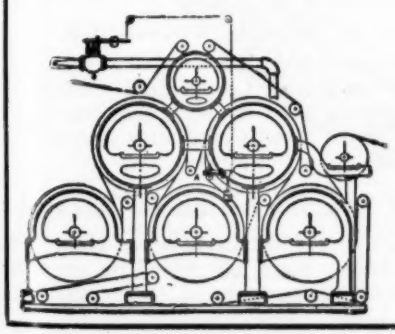

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W. F. PICKLES **Buckland, Conn.**

New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, September 12, 1934.

Some improvement transpired in the local paper market during the past week. Demand for most of the standard grades of paper was slightly more active. Inquiries for future account are becoming more numerous, indicating livelier trading in the near future. Sales forces of the leading paper organizations continue optimistic.

The newsprint paper market is practically marking time. Manufacturing operations in the United States, Canada and Newfoundland are proceeding in sufficient volume to take care of current requirements. Advertising lineage in the leading newspapers is still running ahead of last year's record. Prices remain unchanged.

Demand for the various grades of fine paper is fairly persistent. Prices are steady. Tissues are moving into consumption in satisfactory volume for the season. The coarse paper market is exhibiting a fairly strong undertone. Prices are holding to schedule. The paper board market is moderately active.

Mechanical Pulp

The ground wood pulp market is steadier than of late. No further price reductions have been reported since last week. Production of mechanical pulp in the United States, Canada and abroad is being maintained in normal volume for the time of year and accumulations are not regarded as excessive.

Chemical Pulp

Although the prevailing demand for both domestic and imported chemical pulp is light at present there are a number of inquiries around for future business and the future outlook is more promising. Supplies are moving into consumption in good volume. Prices are generally holding to schedule.

Old Rope and Bagging

The position of the old rope market is practically unchanged. Paper mill demand for old manila rope continues restricted. Small mixed rope is dull. The bagging market is irregular. Gunny bagging is displaying strength, while scrap bagging is quiet. Roofing bagging is only moderately active.

Rags

Affected by the strike in the textile industry, the domestic rag market is exhibiting a stronger undertone. Demand for new cotton rags is slightly better. No. 1 white shirt cuttings and fancy shirt cuttings are arousing interest both in this country and abroad. Roofing grades are moving in good volume for the season.

Waste Paper

The paper stock market is more buoyant. Following a joint conference of committees representing the Code Authorities of the Paper Board and Waste Paper Industries, held in New York last week, it was announced that the board mills are sincerely desirous of co-operating to stabilize waste paper quotations on a mutually satisfactory basis.

Twine

Conditions in the local twine market are fairly satisfactory. Demand for the various grades is fairly active and, judging from inquiries received for future needs, the record for the closing months of the year should compare favorably with the results of the corresponding period last year. Prices are fairly steady.

Schroon River Reorganizes

[FROM OUR REGULAR CORRESPONDENT]

WARRENSBURG, N. Y., September 10, 1934.—A reorganization of the Schroon River Pulp and Paper Company has been effected and plans are under way to place the mill in operation as soon as possible. Albert L. Emerson has been chosen president of the new board of directors and among the other members are Joseph Giannini and Philip E. Rice, all well known in the paper industry. It was also announced that Franklin E. Pasco will continue as general superintendent of the plant, a position he has capably filled for the past several years. Officials stated that sufficient orders are on hand to keep the mill running for an indefinite period. The company has been booking orders since last February and some contracts were passed up because of requests for immediate delivery. Resumption of operations is expected to prove beneficial to neighboring towns connected with the industry as well as improve general business conditions here. For the past three years the plant has operated on a part time basis and for a number of months it was shut down completely.

Repairs and alterations have already been started and the machinery will be in first class condition when the mill is opened. The mill normally employs about 90 hands on a daily schedule of three shifts and it is understood that all former workers will be recalled. Orders were sent out last week to rush materials here as quickly as possible so that production can be started. Mr. Emerson is being commended on all sides for his individual efforts in reorganizing and refinancing the company. The plant is regarded as the largest enterprise in this section and only a few years ago the weekly payroll averaged $3,000.

Mead Corp. to Rebuild Laboratory

DAYTON, Ohio, September 11, 1934—R. T. Houk, Sr., Vice President of the Mead Corporation, Chillicothe, Ohio, states that the work of restoring the four story laboratory building of the Mead Corporation damaged by a $75,000 fire recently will be started at once.

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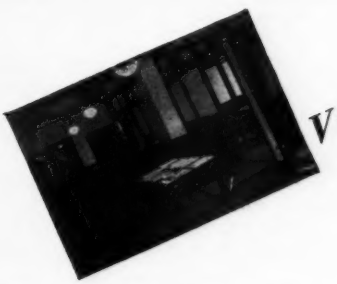

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SVANÖ AKTIEBOLAG
Svanö, Sweden

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, September 12, 1934.

BLANC FIXE.—The blanc fixe market is displaying a stronger undertone. Prices are holding to schedule. The pulp is quoted at from $42.50 to $45 per ton, in bulk; while the powder is selling at from 3½ cents to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER.—Demand for bleaching powder is slightly better. The contract movement is well up to average for the time of year. Prices are steady and unchanged. Bleaching powder is quoted at from $1.90 to $2.15 per 100 pounds, in drums, at works.

CASEIN.—The casein market is marking time. Domestic standard ground is quoted at 12 cents and finely ground at 12½ cents per pound, in bags, car lot quantities. Offerings of Argentine standard ground and finely ground are scarce and prices nominal.

CAUSTIC SODA.—Conditions in the caustic soda market are fairly satisfactory. Prices remain unchanged. Solid caustic soda is quoted at from $2.60 to $3.10; while the flake and ground are selling at from $3 to $3.05 per 100 pounds, in large drums, at works.

CHINA CLAY.—The china clay market is fairly buoyant. Imported china clay is quoted at from $13.50 to $21 per ton, ship side. Effective October 1, minimum quotations on domestic paper-making clay will be established at from $6.50 to $12 per ton, at works.

CHLORINE.—Steadiness prevails in the chlorine market. The contract movement is normal for the season. Prices remain unchanged. Chlorine is quoted at from $2 to $2.25 per 100 pounds, in tanks, or multi-unit cars, in ton lots, or over, at works.

ROSIN.—The rosin market is fluctuating slightly. Paper-making gum rosin is quoted at from $5.45 to $5.55 per 280 pounds, in barrels, at works; wood rosin at $4.30 per 280 pounds, in barrels, and rosin wax size at 5 cents per pound, from shipping points.

SALT CAKE.—Trading in the salt cake market is brisk. Prices are holding to schedule. Salt cake is quoted at from $12 to $14 and chrome salt cake at from $12 to $12.50 per ton, at works. Imported salt cake is quoted at from $12 to $12.50 per ton, on dock.

SODA ASH.—The soda ash market is moderately active. Prices are generally holding to previously quoted levels. Quotations on soda ash, in car lots, at works, per 100 pounds, are still as follows: in bulk, $1.10; in bags, $1.40; and in barrels, $1.50.

STARCH.—Due to the continued strength of the basic product, the starch market remains steady to firm. Prices are holding to schedule. Special paper-making starch is quoted at $3.57 per 100 pounds, in bags; and at $3.84 per 100 pounds, in barrels, at works.

SULPHATE OF ALUMINA.—Business in the sulphate of alumina market is improving with the wane of the holidays. Commercial grades are quoted at from $1.35 to $1.50; while iron free is selling at from $1.90 to $2.05 per 100 pounds, in barrels, at works.

SULPHUR.—The sulphur market is steady. Sulphur is quoted at $18 per long ton on orders of 1,000 tons, or over, on yearly contracts; and at $20 per ton on any smaller quantity over that period. On spot and nearby carloads, the quotation is $21 per ton.

TALC.—Most of the business transacted in the talc market during the past week was along routine lines. Domestic talc is still quoted at from $16 to $18 per ton, in bulk, at eastern mines; while imported talc is selling at from $23 to $30 per ton, on dock.

Market Quotations

Paper

(F. o. b. Mill)

Ledgers	6.50	@	—
Bonds	6.00	@	—
Index	6.00	@	—
Writings—			
Extra Superfine	6.50	@	—
Superfine	6.25	@	—
Tub sized	5.75	@	—
Engine sized	5.50	@	—
Book, Cased—			
S. & S. C.	5.35	@	5.75
S. & S. C. Litho.	5.60	@	6.00
M. F.	5.10	@	5.50
Coated and Enamel	5.90	@	6.55
Coated Litho	5.90	@	6.55
Tissues—Per Ream—			
White No. 1	.82½	@	.85
White No. 2	.67½	@	—
Anti-Tarnish M. G. only	1.00	@	—
Colored	.85	@	—
Kraft	.70	@	—
Manila	.67½	@	.70
Manila—			
No. 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00
Butchers	4.00	@	4.50
Fibre Papers—			
No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75
Common Bogus	1.50	@	3.00
Screenings	2.50	@	3.50
Glassine—			
Bleached	.11	@	—
Unbleached	.09	@	—

(The following Quotations are Delivered New York)

News, per ton—			
Roll, contract	40.00	@	—
Rolls, spot	40.00	@	—
Sheets	45.00	@	—
Kraft—			
No. 1 Domestic	4.75	@	5.00
No. 2 Domestic	3.87½	@	—
Southern	3.87½	@	—
Boards—per ton—			
News	40.00	@	45.00
Chip	37.50	@	40.00
Sgl. Mla. Lt. Chip	52.50	@	57.50
Jute Lined Chip	47.50	@	52.00
White Patent Coated	60.00	@	65.00
Binders Boards	67.00	@	75.00

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	22.00	@	24.00
Dry	23.00	@	24.00
(F.o.b. Mill)			
No. 1 Domestic and Canadian	22.00	@	26.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Division 1	2.85	@	—*
Division 2	2.80	@	—*
Division 3	2.75	@	—*
Prime Qualities—			
Class 1. All Prime Easy Bleaching	2.25	@	—*
Other Than Easy Bleaching—			
Class 2. Higher Than Standard	2.20	@	—*
Class 3. Standard	2.15	@	—*
Class 4. Lower than Standard	2.10	@	—

(On Dock, Atlantic Ports)

Kraft No. 1	1.75	@	1.85
Kraft No. 2	1.60	@	1.70

(F.o.b. Pulp Mill)

Kraft Domestic	1.60	@	2.25
(Delivered)			
Soda Bleached	2.50	@	—

*Add 60 Cents per short ton, dock charges, for Albany; $2.00 for Lake Ports East and $3.00 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	5.75	@	6.00
Silesias No. 1	3.75	@	4.00
New Unbleached	6.25	@	6.50
New Soft Blacks	3.00	@	3.25
Blue Overall	3.50	@	3.75
Fancy	2.50	@	2.75
Washables	1.75	@	2.00
Mixed Khaki Cuttings	3.00	@	3.25
O. D. Khaki Cuttings	3.75	@	4.00
Men's Corduroy	1.50	@	1.75
New Mixed Blacks	2.50	@	2.75

Old Rags

White, No. 1—			
Repacked	3.00	@	3.50
Miscellaneous	2.75	@	3.25
White, No. 2—			
Repacked	1.75	@	2.25
Miscellaneous	1.50	@	1.75
Thirds and Blues—			
Repacked	1.50	@	1.75
Miscellaneous	1.25	@	1.50
Black Stockings	2.50	@	3.00
Roofing Rags—			
No. 1	1.10	@	1.25
No. 2	.80	@	.85
No. 3	.70	@	.75
No. 4	.65	@	.70
No. 5A	.60	@	.65

Foreign Rags

New Rags

New Dark Cuttings	1.60	@	1.70
New Mixed Cuttings	1.75	@	1.85
New Light Silesias	3.75	@	4.00
Light Flannelettes	3.75	@	4.00
Unbleached Cuttings	6.50	@	6.75
New White Cuttings	6.50	@	6.75
New Light Oxfords	3.25	@	3.50
New Light Prints	2.75	@	3.00

Old Rags

No. 1 White Linens	7.50	@	8.00
No. 2 White Linens	6.50	@	7.00
No. 3 White Linens	4.50	@	5.00
No. 4 White Linens	2.25	@	2.50
No. 1 White Cotton	4.25	@	4.75
No. 2 White Cotton	3.25	@	3.75
No. 3 White Cotton	2.50	@	2.75
No. 4 White Cotton	1.90	@	2.15
Extra Light Prints	2.00	@	2.25
Ord. Light Prints	1.75	@	1.85
Med. Light Prints	1.55	@	1.65
Dutch Blue Cottons	1.75	@	1.85
French Blue Linens	2.30	@	2.40
German Blue Linens	2.15	@	2.25
German Blue Cottons	1.70	@	1.80
Checks and Blues	1.30	@	1.40
Linsey Garments	1.40	@	1.60
Dark Cottons	1.00	@	1.10
Old Shopperies	.95	@	1.00
New Shopperies	.90	@	1.00
French Blues	1.70	@	1.80

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	1.50	@	1.60
Domestic	1.40	@	1.50
Wool Tares, light	1.20	@	1.30
Wool Tares, heavy	1.20	@	1.30
Bright Bagging	1.15	@	1.25
Manila Rope—			
Foreign	2.35	@	2.45
Domestic	2.25	@	2.50
Small Mixed Rope	1.10	@	1.35
New Burlap Cut	2.00	@	2.25
Hessian Jute Threads—			
Foreign	2.60	@	2.75
Domestic	2.80	@	3.00

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	2.70	@	2.80
Ordinary Hard White No. 1	2.15	@	2.25
Hard White No. 2	1.95	@	2.05
Soft White No. 1	1.85	@	1.95
Flat Stock—			
Stitchless	.80	@	.90
Over issue Mag.	.80	@	.90
Solid Flat Book	.65	@	.75
Crumpled No. 1	.60	@	.65
Solid Book Ledger	1.50	@	1.65
Ledger Stock	1.00	@	1.10
New B. B. Chips	.30	@	.35
Manilas—			
New Env. Cut	1.70	@	1.80
New Cuttings	1.35	@	1.45
Print	Nominal		
Bogus Wrapper	.40	@	.50
Container	Nominal		
Old Kraft Machine—			
Compressed bales	1.10	@	1.20
News—			
No. 1 White News	1.15	@	1.25
Strictly Overissue	.65	@	.70
Strictly Folded	.42½	@	.50
No. 1 Mixed Paper	.32½	@	.40

Twines

(F. o. b. Mill)

Cotton—			
B. C. 18 basis	.30	@	.32
No. 1	.20	@	.22
No. 2	.19	@	.20
No. 3	.17	@	.18
A. Italian, 18 basis	.36	@	.37
Finished Jute—			
Dark, 18 basis	.18	@	.20
Light, 18 basis	.20	@	.22
Jute Wrapping, 3-6 Ply—			
No. 1	.15½	@	.16½
No. 2	.15	@	.16
Tube Rope—			
4-ply and larger	.09¼	@	.09¾
Fine Tube Rope—			
4-ply	.11¼	@	.11¾
3-ply	.14¼	@	.14¾
2-ply	.14¼	@	.14¾
Paper Makers Twine	.08¼	@	.13¼
Box Twine, 2-3 ply	.14¼	@	.14¾
White Hemp	.13¼	@	.16¾
Java Sisal—			
No. 1 Basis	.11½	@	—
No. 2 Basis	.10½	@	—
New Zealand Sisal	.11½	@	—
Sisal Lath Yarn—			
No. 1	.13½	@	.15½
No. 2	.11½	@	.13½
Manila Twine	.24½	@	.29½

CHICAGO

Paper

(F. o. b. Mill)

Rag Bond	.12	@	.50
Water Marked Sulphite Bond	.06¾	@	.11
Sulphite Bond	.05½	@	.11
Superfine Writing	.18	@	.24
No. 1 M. F. Book	.06½	@	.07¾
No. 2 M. F. Book	.05¼	@	.06¾
No. 1 S.&S.C. Book	.06¾	@	.07¾
No. 2 S.&S.C. Book	.05¾	@	.06½
Coated Book	.07	@	.12
Coated Label	.07	@	.08½
No. 1 Manila	.04¼	@	.05¾
No. 1 Fibre	.04¾	@	.05¼
No. 2 Manila	.04¼	@	.04¾
Butcher's Manila	.03¾	@	.03¾
No. 1 Kraft	4.75	@	5.00
Southern Kraft	3.88	@	4.25
No. 2 Kraft	3.88	@	4.25
Wood Tag Boards	.04¼	@	.06¼
Sulphite Screenings	.03	@	.03¾
Manila Tissue	.05¾	@	.07
White Tissue	.07	@	.09

(Delivered Central Territory)

News, per ton—			
Rolls, contract	41.00	@	—
Sheets, open	46.00	@	51.00
Boards, per ton—			
Plain Chip	46.50	@	—
Solid News	50.00	@	—
Manila Lined Chip	55.00	@	—
Patent coated	65.00	@	—
Container Lined—			
85 Test, per 1000 sq. ft.			1.70
100 Test, per 1000 sq. ft.			1.85

Old Papers

(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope cuttings	1.70	@	2.00
No. 1 Hard White	1.40	@	1.65
No. 1 Soft White	1.25	@	1.50
Ledger & Writings	.70	@	.80
Solid Books	.60	@	.70
Blanks	1.00	@	1.05
Krafts	.80	@	.90
New Kraft Cuts	1.20	@	1.30
Manila Env. Cuts	1.25	@	1.30
Ex. No. 1 Manila	.90	@	1.00
Print Manila	.50	@	.55
Overissue News	.60	@	.70
Old Newspapers—			
No. 1	.50	@	.55
Mixed Papers—			
No. 1	.30	@	.35
Roofing Stocks—			
No. 1	30.00	@	—
No. 2	28.00	@	—

PHILADELPHIA

Paper

(Delivered Philadelphia)

Bonds	.05-9/10	@	.38
Ledgers	.06 9/10	@	.40
Writings—			
Fine No. 3	.05	@	.06
Superfine	.10	@	.18
Extra Fine	.15	@	.24
Fine	.15	@	.25
Fine, No. 2	.10	@	.25
Book, M. F.	.05¼	@	.06¾
Book, S. S. & C.	.05	@	.07½
Book, Coated	.06½	@	.09
Coated Lithograph	.06¼	@	.08½
Label	.07	@	.11
No. 1 Jute Manila	6.25	@	—
Manila Sul., No. 1	5.25	@	—
Manila No. 2	3.00	@	—
No. 1 Kraft	5.00	@	—
Southern Kraft	4.75	@	—
Common Bogus	.03	@	.04½
News Print Rolls	46.00	@	55.00
Straw Board	40.00	@	45.00
News Board	50.00	@	—
Chip Board	45.00	@	—
Wood Pulp Board	70.00	@	85.00
Binder Boards—			
No. 1, per ton	75.00	@	80.00
No. 2, per ton	70.00	@	75.00
Carload lots	65.00	@	70.00
Tarred Felts—			
Regular	52.25	@	54.25
Slaters (per roll)	.84	@	.94
Best Tarred, 1-ply (per roll)	1.95	@	2.10
Best Tarred, 2-ply (per roll)	1.50	@	1.60
Best Tarred, 3-ply	2.00	@	2.25

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1	.03½	@	.04
New White, No. 2	.02½	@	.04
Light Silesias	.02½	@	.03
Silesias, No. 1	.03	@	.03½
Black Silesias, soft	.02½	@	.03
New Unbleached	.05	@	.05½
Washable, No. 1	.01½	@	.02
Blue Overall	.03½	@	.04
Cottons—According to grades—			
Washable, No. 2	.02½	@	.03
New Blue	.01½	@	.03
Fancy	.01½	@	.03
New Black Soft	.02	@	.04
New Light Seconds	.01½	@	.02
New Dark Seconds	1.50	@	1.75

Khaki Cuttings

No. 1 O.D.	.03	@	.04
No. 2 Mixed	.03	@	.04
Corduroy	.02	@	.03
New Canvas	.03½	@	.04½
New Black Mixed	.02½	@	.03½

Domestic Rags (Old)

White No. 1—			
Repacked	2.50	@	3.50
Miscellaneous	1.75	@	2.25
M. G.	3.00	@	3.75
Thirds and Blues—			
Miscellaneous	1.00	@	1.50
Repacked	1.50	@	2.00
Black Stockings (Export)	2.00	@	3.50
Roofing Stock—			
Foreign No. 1	.50	@	.75
Repacked	.70	@	.85

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.25	@	1.50
Domestic	1.50	@	1.75
Manila Rope	2.00	@	2.25
Sisal Rope	1.25	@	1.50
Mixed Rope	1.00	@	1.10
Scrap Burlaps—			
No. 1	1.25	@	1.50
No. 2	.80	@	1.00
Wool Tares, heavy	2.75	@	—
Mixed Strings	1.15	@	1.25
No. 1 New Light Burlap	2.25	@	2.50
New Burlap Cuttings	2.00	@	2.25

Old Papers

(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	2.25	@	2.30
No. 2 Hard White	1.90	@	2.00
No. 1 Soft White	1.80	@	1.85
No. 2 Soft White	1.25	@	1.30
No. 1 Mixed	—	@	.75
Solid Ledger Stock	1.50	@	1.60
Writing Paper	1.10	@	1.20
No. 1 Books, heavy	.65	@	.70
No. 1 New Manila	1.35	@	1.40
Print Manila	.50	@	.60
Container Manila	.45	@	.50
Old Kraft	1.00	@	1.10
No. 1 Mixed Paper	.32½	@	—
Straw Board Chip	.30	@	—
Binders Board Chip	.30	@	—
Corrugated Board	.50	@	—
Overissue News	.60	@	—
Old Newspapers	.42½	@	—

BOSTON

Paper

(F. o. b. Mill)

Ledgers—			
Sulphite	.06	@	.12½
Rag Content	.12	@	.30
All Rag	.36	@	.52½
Bonds—			
Sulphite	.07¼	@	.11
Rag Content	.12	@	.30
All Rag	.36	@	.65
Writings	.06½	@	.20
Superfines	.11	@	.31
Book, Super	.06	@	.09
Book, M. F.	.05½	@	.08½
Book, Coated	.08½	@	.18
Coated Litho	.09	@	.12
Label	.09½	@	.15
Jute Manila No. 1	.11	@	.13
Manila, Sul. No. 1	.04¾	@	.06¾
Manila, Sul. No. 2	.03¾	@	.04½
No. 1 Kraft	.04¾	@	.05
No. 2 Kraft	.03½	@	.04¾

(F. o. b. Boston)

Southern Kraft	.03½	@	.04¾

(F. o. b. destination in carload lots, f. o. b. mill in less than carload lots.)

Common Bogus	.02	@	.02¾

(Delivered New England points)

News Print, rolls	44.50	@	—
Straw Board, rolls	.009	—	@35.00
Straw Board in Sheets, basis 35s to 70s	—	@40.00	
Filled News Board	40.00	@45.00	
Chip Board	37.50	@40.00	
Chip Board (Creasing)	37.50	@40.00	
Single Manila Lined Chip	47.50	@52.50	
Single White, Patent Coated News Board (Bender)	57.50	@65.00	
Wood Pulp Board	70.00	@75.00	
Binder Boards (Standard Grade)	67.00	@75.00	

Old Papers

(F. o. b. Boston)

Shavings—			
No. 1 Hard White	2.20	@	2.35
No. 1 Soft White	1.75	@	2.00
No. 2 Mixed	.80	@	.85
Solid Ledger Books	1.75	@	—
Overissue Ledger Stock	1.15	@	1.30
Mixed Ledgers	.95	@	1.05
No. 1 Books, heavy	.85	@	.90
No. 1 Books, light	.65	@	.75
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.25	@	1.30
No. 1 Old Manila	.65	@	.70
White Blank News	1.10	@	1.15
No. 1 Kraft	1.05	@	1.10
Manila	.55	@	.60
No. 1 Mixed Papers	.35	@	—
Print Manila	.45	@	.50
Overissue News	.50	@	.55
Old Newspapers	.45	@	—
Box Board Chips	.32½	@	.35
Corrugated Boxes	.40	@	.42½
Screening Wrappers	.50	@	.60

Bagging

(F. o. b. Boston)

Manila Rope—			
Foreign	1.90	@	2.00
Domestic	2.00	@	2.20
Transmission Rope	.90	@	1.00
Mixed Strings	.40	@	—
Jute Rope	1.35	@	1.40
Jute Carpet Threads	.65	@	.70
Gunny No. 1—			
Foreign	1.50	@	1.60
Domestic	1.25	@	—
Bleachery Burlap	4.00	@	4.50
Scrap Burlap	1.05	@	1.10
Scrap Sisal	1.10	@	1.20
Scrap Sisal for shredding	1.00	@	1.25
Wool Tares, heavy	1.25	@	1.30
New Burlap Cuttings	1.45	@	1.50
Australian Wool Pouches	2.00	@	2.25
Heavy Baling Bagging	1.40	@	1.50
Paper Mill Bagging	.90	@	1.10
Bagging No. 2	.50	@	.55

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.01¾	@	.02
New White No. 1	.05½	@	.06
New White No. 2	.03½	@	.04
Silesias No. 1	.04	@	—
New Black Silesias	.02½	@	.03
New Unbleached	.05½	@	.06
Blue Cheviot	—	@	4.65
Fancy	—	@	.02½
Washable	.02¾	@	—
Cottons—According to grades—			
Blue Overalls	—	@	.03¾
New Black, soft	04	@	04½
Khaki Cuttings	.03	@	.03¾
O. D. Khaki	.02¾	@	.03
Corduroy	.01¾	@	.02
New Canvas	—	@	05
B.V.D. Cuttings	—	@	.06¾

Domestic Rags (Old)

(F. o. b. Boston)

Canvas	.04½	@	
White No. 1—			
Repacked	—	@	3.00
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	2.00	@	2.75
Miscellaneous	2.00	@	2.25
Twos and Blues	1.25	@	1.50
Thirds and Blues			
Repacked	2.00	@	2.75
Miscellaneous	2.00	@	2.25
Black Stockings	2.25	@	2.50
Roofing Stock			
No. 1	.80	@	.85
No. 2	.65	@	.70
No. 3	.55	@	.60

Foreign Rags

(F. o. b. Boston)

Dark Cottons	.85	@	.95
New White Shirt Cuttings	5.50	@	6.00
Dutch Blues	2.00	@	2.50
New Checks & Blues	2.50	@	3.00
Old Fustians	1.55	@	1.60
Old Linsey Garments	1.25	@	1.35

TORONTO

Paper

(F. o. b. Mill)

Bond—			
No. 1 Sulphite	.10¼	@	—
No. 2 Sulphite	.08½	@	—
No. 1 Colored	.10¼	@	—
No. 2 Colored	.09	@	.10
Ledgers (sulphite)			
Ledgers, No. 1	.34½	@	—
Ledgers, No. 2	.25½	@	—
Writing	.09	@	.09½
Book—			
No. 1 M. F. (Carloads)	6.20	@	—
No. 3 M. F. (Carloads)	5.70	@	—
No. 4 M. F. (carloads)	4.75	@	—
No. 1 S. C. (carloads)	6.65	@	—
No. 3 S. C. (carloads)	6.20	@	—
No. 4 S. C. (carloads)	5.20	@	—
No. 1 Coated and Litho	12.00	@	—
No. 2 Coated and Litho	10.50	@	—
No. 3 Coated and Litho	9.50	@	—
Coated tinted	14.00	@	—
Wrapping—			
Rag Brown	4.25	@	—
White Wrap	2.22½	@	—
"B" Manila	4.75	@	—
No. 1 Manila	5.25	@	—
Fiber	5.25	@	—
Kraft, M. F.	5.75	@	—
Kraft No. 2	5.25	@	—

(F.O.B. Cars Toronto)

News, per ton—			
Rolls (contract)	45.50	@	—
Sheets	50.50	@	—

Pulp

(F. o. b. Mill)

Ground Wood	18.00	@	20.00
Sulphite easy bleaching	40.00	@	—
Sulphite, news grade	38.00	@	—
Sulphite, bleached	50.00	@	55.00
Sulphate	50.00	@	—

Old Waste Paper

(In carload lots, f. o. b. Toronto)

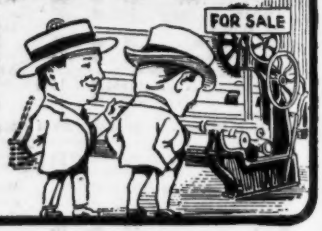
Shavings—			
White Env. Cut	2.00	@	2.30
Soft White	1.60	@	1.90
White Blk. News	1.25	@	1.40
Book and Ledger—			
Flat Magazine and Book Stock (old)	.90	@	1.00
Light and Crumpled Book Stock	.80	@	.90
Ledgers and Writings	1.00	@	1.05
Manilas—			
New Manila Cut	1.25	@	1.50
Printed Manilas	.70	@	.60
Kraft	1.25	@	1.30
News and Scrap—			
Strictly Overissue	.80	@	—
Strictly Folded	.60	@	—
No. 1 Mixed Paper	.50	@	—

Domestic Rags

(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.06	@	.06¼
Fancy Shirt Cuttings	.02¾	@	.02½

The CLEARING HOUSE of THE PAPER TRADE



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EXPERT all around machinists with bag machinery experience. Good opportunity for permanent location. Only those with bag machinery experience need apply. Address Box 34-396, care Paper Trade Journal. S-13

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SKILLED Paper Millright Machinist wishes change. 24 years experience. 6 years as paper maker and 18 years as Millwright and Master Mechanic. Cylinder and Fourdrinier Machines. Address Box 34-389, care Paper Trade Journal. S-13

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17 John Street New York, N. Y.

SITUATIONS WANTED

BOARD MILL SUPERINTENDENT — 45 years old. Married. 25 years experience all grades folding box and specialties. Production quality and mill maintenance guaranteed. Address Box 34-283, care Paper Trade Journal. S-27

PLANT ENGINEER with wide experience in design, construction, maintenance and operation of pulp and paper mill desires new position. Address Box 34-400 care Paper Trade Journal. O-4

WANTED—Position as MANAGER or SUPERINTENDENT of mill making binders, leather and other boards. Middle aged man. Good at construction and repairs. Address A. Martin, 100 Lancaster Ave., Downingtown, Pa. A-13

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FOR SALE

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